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The World We Live In

An Introduction to the Social Studies for the Intermediate Grades

BY

LOUIS WEINBERG
Townsend Harris High School, College of the City of New York

ZENOS E. SCOTT
Superintendent of Schools, Springfield, Massachusetts

EVELYN T. HOLSTON
Supervisor, Elementary Education, Springfield, Massachusetts

EXPERIMENTAL EDITION
NOT FOR SALE

D. C. HEATH AND COMPANY

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Foreword to the Teacher

FOR some years there has been a definite demand from teachers of the fourth and fifth grades for a book which would serve as an adequate introduction to geography. *The World We Live In* has been planned to fill this need. It has been planned, furthermore, with the conviction that an *introductory study of geography* takes on added meaning when the history of man's control of the geographic environment and the civic aspects of man's coöperation in the control of nature are fused with geography.

A study of the table of contents will reveal the outline of this plan and will show how the authors have met the problem of correlating geography, history, and civics in such a manner as to give to this book the character of an *elementary introduction to the social studies*.

However divided educators may be in their opinions as to the desirability or practicability of merging history, geography, and civics in the junior-high-school grades, there can be no difference of opinion as to the absolute necessity of presenting to the younger pupils of the intermediate grades an introductory and integrated picture of the world in which they live, through which they can learn (1) to appreciate the earth as man's home, (2) to understand man's life on earth as a progressive experience in the control of nature, and (3) to become familiar with man's ways of living and working together as a progressive growth in the art of human coöperation.

Each chapter in this book, even when it deals with apparently new material, is built around a core of pupil experience. The

teacher can make special application of the chapter content to the pupil's own environment and thus make the book function as a study of *home geography* as well as of local community life and local history. Of course, in the very nature of things, not all that is peculiarly local in pupil experience can be introduced into a text; on the contrary, the application of textual material to the further organization and interpretation of the immediate environmental experiences of children must remain the most interesting and most fruitful contribution of the intelligent teacher.

Teachers interested in the development of constructive imagination, in the creative aspects of teaching, will find particularly useful the illustrations, which have been especially prepared as visualizations of the facts and principles set forth in this text. There are teaching values in line drawings, when intelligently designed as teaching instruments, which photographs, as such, cannot possibly match. Certain of the illustrations, such as "The Eskimo Summer Tent," "Eskimo Tools," "American Indians Gathering Rice," and "Plains Indian Tepee," are drawn directly from models in the American Museum of Natural History. The picture of the Pueblo Indian houses is from a model in the Museum of the American Indian. Such illustrations make possible the classroom study of valuable museum material; they bring the museum, in part, into the classroom. All the pictures set basic functioning concepts before the pupil in the form of concrete visual images. Many of them, especially those of a diagrammatically cartoon nature, organize for the pupil a mass of related concepts. A considerable number of the pictures can be discussed in the class for their geographic implications, their evidence of man's control of nature, and their testimony as to man's coöperation in the control of nature. From the point of view of creative learning,

pupils can be encouraged themselves to create additional visualizations of the text; the pictures in the book then serve to provide either the raw material or the models for such visualizations (as in the case of the diagrammatic cartoons).

It is the hope of the authors that teachers and pupils will find both pleasure and profit from their joint work in the use of this book.

THE AUTHORS

A Word from the Authors to the Children Who Are Reading The World We Live In

We are living in a wonderful world.

Through the ages, men have been struggling to make this world of ours an easier and pleasanter place in which to live.

Man once lived on wild plants for food. He had no fire and no utensils with which to cook. There were many wild animals which were his enemies, and he had no weapons. His clothing was made of the skins of animals, for he had no tools and no skill with which to make clothes. At night he lived in darkness, for there was no light.

But in this world there were many natural resources, and man had a brain and a pair of hands. With his inventive mind he has been able to accomplish all that you will read about in this book. You will understand, as you read, how men and women working together have used the resources of nature to change the world into the kind of place you boys and girls are living in today.

This story of man's struggle, of his successes and failures, is called *history*. The story of the places in the world where these struggles occur is called *geography*. The story of how men have learned to live and work together is often spoken of by your older brothers and sisters as *civics*.

You will find all three stories in this book, and you can appreciate how geography, history, and civics are all parts of the same story if you will read the book carefully and talk about it with your teacher and your classmates.

THE AUTHORS

CONTENTS

CHAPTER PAGE

PART I

A BIRD'S-EYE VIEW OF THE WORLD

1. Around the World by Airplane 3
2. The Path of the Fliers 9

PART II

WORKING TOGETHER: PAST AND PRESENT

3. Why the World Works 17
4. The Earth as a Storehouse 23
5. The Earth as a Workshop 32
6. When the Whole World Was a Wilderness . . . 45
7. How Man Conquered the Wilderness 49
8. The Nations of the Earth 57

PART III

FEEDING THE WORLD

9. Why We Need Food 63
10. How We Get Our Meat 69
11. Milk, Cream, Butter, and Cheese 76
12. Poultry and Eggs 83
13. Food from the Sea 88
14. Wheat and Other Grains 94
15. A Basket of Plant Foods 103
16. Water and Salt 111

CHAPTER PAGE

PART IV

CLOTHING THE WORLD

17. The Clothes We Wear 123
18. Clothing from Animals: Furs and Leather . . 128
19. Clothing from Animals: Wool and Silk . . . 136
20. Clothing from Plants: Cotton, Linen, Rubber . 147

PART V

HOMES THE WORLD OVER

21. The Story of the House 159
22. Materials for Building the House 166
23. Furnishing the Home 181

PART VI

BINDING THE WORLD: TRANSPORTATION—COMMUNICATION

24. Carrying and Being Carried 189
25. Buying and Selling: The Story of Trade . . . 200
26. Sending Messages: The Spoken Word, The Written Word, The Printed Word 209
27. Sending Messages: Telegraph, Cable, Telephone, Wireless, Radio 215

PART VII

TOOLS THAT HELP IN THE WORLD'S WORK

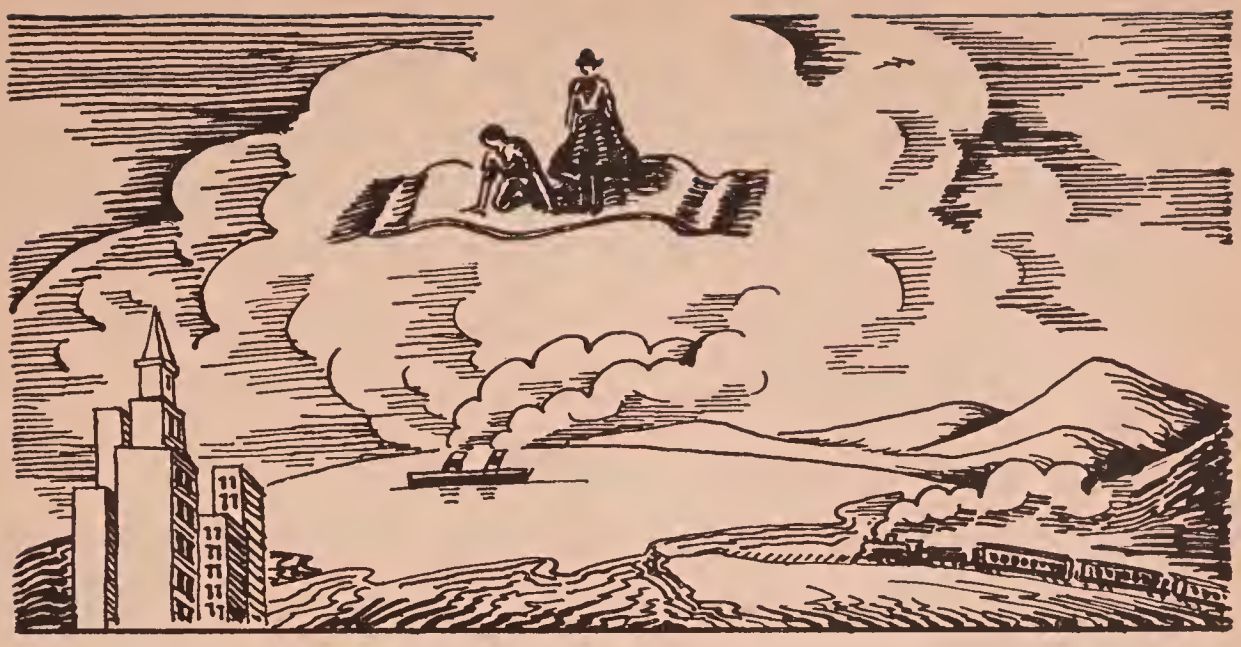
28. How Man Uses Tools to Increase His Power . 223
29. Copper, Iron, Steel, Coal, and Oil Make Tools Possible 231
30. Books as Tools 248

PART I

A BIRD'S-EYE VIEW OF THE WORLD

CHAPTER

1. Around the World by Airplane
2. The Path of the Fliers



Chapter 1

AROUND THE WORLD BY AIRPLANE

Long ago some one wrote a story about a magic carpet which could fly through the air and carry people to any place in the world. Since that time, many boys and girls have wished that the story were true and that they, too, could see the world from a magic carpet.

Today the story of the magic carpet has come true. Men do go flying through the air. They fly, not on make-believe magic carpets, but in airplanes.

One day in May, in the year 1924, eight Americans in four airplanes set out to fly all the way around the world. Less than six months later, after many adventures, two of the planes completed the trip.

In their journey the airplanes flew over many lands and many waters. There were stormy days when the men flew through rain, fog, sleet, and snow which sometimes made it

impossible for them to see the earth below them; but there were clear days, too, when they could see for miles and miles in all directions.

Looking Down on Lands and Waters

Looking down from their planes, the fliers saw a goodly portion of the world in which we live, with its oceans and mountains, its rivers and valleys and plains, its farms, pastures, villages, towns, and cities.

For part of their trip the airplanes flew over oceans where waves rolled on and on for thousands of miles. Every now and then the fliers could see a sailboat or a steamboat pushing its way through the waters.

Whenever the planes were flying over an ocean, the airmen were eager to reach their next landing place as quickly as possible. Oceans are dangerous for airplanes.

To make the ocean flights less dangerous, the planes were built so that they would float in case of accidents over the sea. As things turned out, this was a wise precaution. One of the planes, finding itself in trouble, did have to drop into the ocean. It floated for four hours before passing ships came to the rescue. The men were saved, but the pounding waves destroyed the plane.

In flying over land, the airmen found the crossing of the wild mountain country the most dangerous part of their task.

As they came near the mountain country, the men first saw low hills rising a few hundred feet or more from the

earth. Then behind the hills they saw mountains rising thousands of feet into the air. To the fliers these mountains were like walls blocking their path.

As the planes rose to fly over the mountains, the men could see dark forests growing on the mountain sides. Looking down on the tops of the higher mountains, they could see

Plain **Hills** **Mountains**

snow and ice. On those frozen peaks, neither plants nor animals can live. An accident while flying over the mountains might prove at least as dangerous as engine trouble over an ocean.

One day while flying through clouds and mist, one of the planes struck a mountain side and was destroyed. What happened to the men we shall read in a later chapter.

There were times when the men flew for hours over plains where the earth is level for hundreds of miles. Looking through their field glasses, they could see that these plains

Looking Down on Lands and Waters

are not all alike. Some of these plains are farming lands; some are pasture lands; and some are plains of sand called *deserts*.

Looking down on the farming lands, the fliers saw growing crops of grain, fruits, and vegetables. On the pasture lands the fliers saw cattle and sheep grazing on the wild grass. On the deserts the fliers saw few plants growing and no animals grazing.

In the course of their flight the fliers looked down on many a valley where the earth seemed like a great basin between hills and mountains. Rivers flow in these valleys. Branch rivers flow into the great rivers. These branch rivers are formed from the rain and snow which fall on the hills and mountains.

Some of the river valleys were busy places. Back from the banks of the rivers, the fliers could see farmhouses and the fields in which the farmers raise their crops. Along the river banks they could see small villages where a few hundred people live in houses built close together. They could see towns where a few thousand people dwell. Here and there in these valleys the fliers looked down on cities where many thousands of people make their homes. From above, the city buildings appeared like tall blocks set in rows.

Not all the cities were in river valleys. The airmen saw cities built on the shores of large bodies of inland water. These bodies of water look like oceans, only they are smaller and are called *lakes*. The men saw cities rising straight up above riverless, treeless plains. Even in the heart of wild mountain country they occasionally saw a city.

Home Again

When the fliers, coming home from their long trip, saw the cities of their own United States again, they were happy. When they landed they were hailed with joy. The people were proud of the fliers and were glad to welcome them home again.

Chapter 2

THE PATH OF THE FLIERS

In their trip around the world the fliers journeyed 27,534 miles. The flight took them 5 months and 22 days. But the real flying time was only 351 hours and 11 minutes, or 14 days, 15 hours, and 11 minutes.

The airmen flew by day. At night they landed to rest. Often on account of poor weather conditions or engine trouble they had to stay where they landed for a day, a week, or even longer. Then, when they were ready, they rose into the air and flew on.

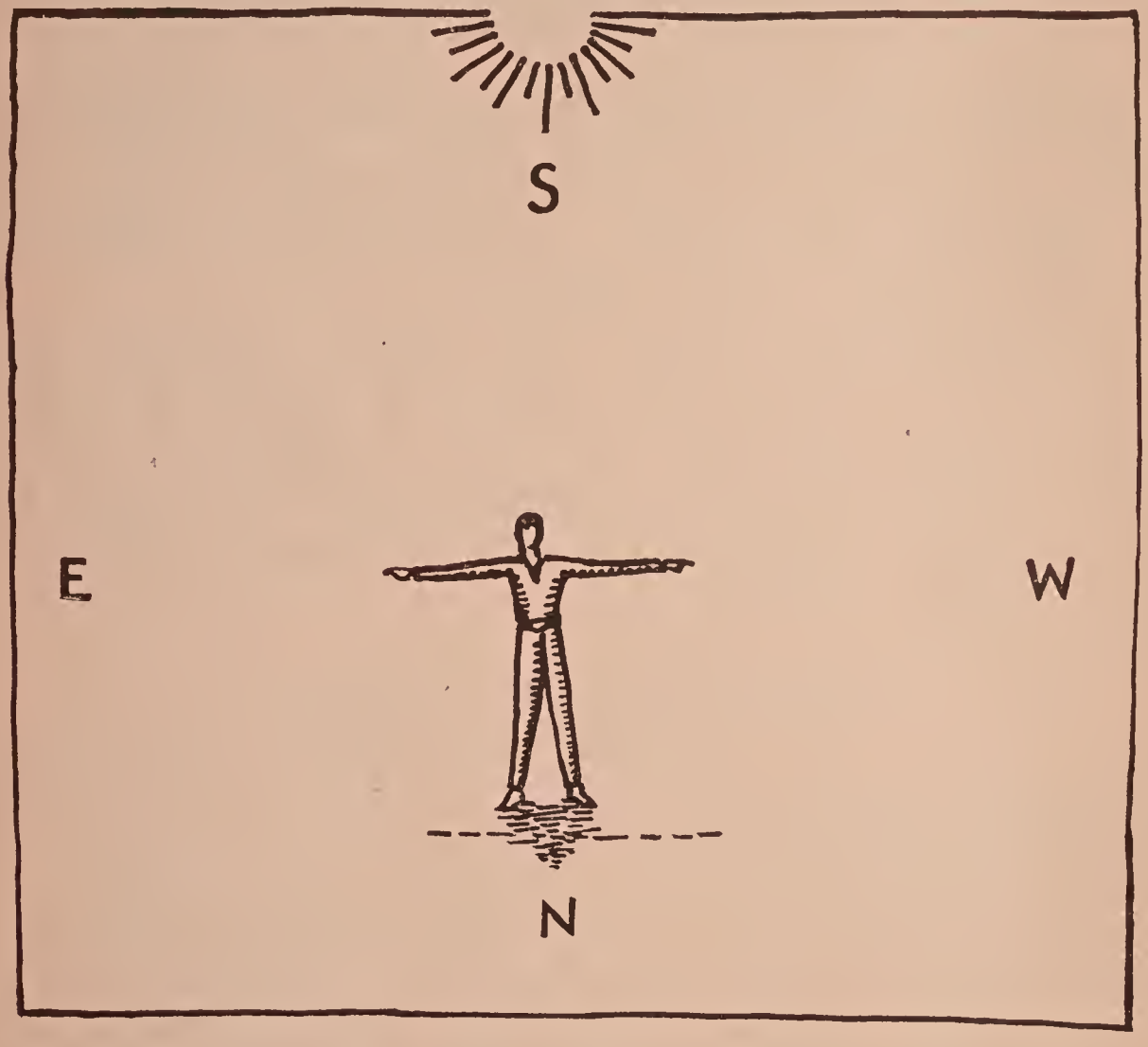
The Flight Begins in Seattle

The men started from the city of Seattle on the Pacific coast of the United States.

They first flew north. If you wish to know which way is north, stand at noon with your back to the sun. Stretch your arms out sidewise. The south will be behind you, your right arm will be pointing to the east, your left arm to the west, and you will be facing the north.

The fliers had an easier way of knowing direction. Wherever they were and at any time of night or day, they could tell north, south, east, and west by looking at a compass. A compass has a needle which points towards the north. North, south, east, and west are all marked on the compass.

The fliers were also guided by maps, or drawings of the earth, which showed them the shapes of the different lands and waters of the world. Their maps showed them where each place is; whether it is north or south or east or west of



some other place. Have you ever taken a long ride in an automobile to some place where you have never been before? Do you remember your father taking a map out of his pocket to find which way to go?

Looking at their maps these fliers saw that Alaska, the first place which they wished to reach, lies toward the north. Then they looked at their compasses and flew northward.

The fliers left Seattle in May, when it was almost summer there. When they reached Alaska a few days later, they found the weather cold. There are parts of Alaska where it is cold almost all the year round.

The fliers found sudden changes in weather throughout their journey. Whenever they flew far up into the north countries, they found the climate cold. When they flew south again, they found the climate warmer. But we are getting ahead of our story.

Across the Pacific Ocean

Leaving Alaska, the fleet of airplanes turned westward to cross the Pacific Ocean. It was here, only a short distance from the mainland, that one of the planes was wrecked by flying against a mountain side. This happened on one of the Aleutian Islands, off the coast of Alaska. The three remaining planes continued on their westward flight.

The wind over the Pacific was fierce and chill, and the fliers were glad when they came to islands in the ocean upon which they could land and find shelter. On one of the islands of Japan, school children celebrated the landing of the fliers by singing songs to them from a hillside. Journeying on beyond Japan, the men reached the mainland of the great continent called Asia.

Over Asia and Europe

To cross Asia, the airmen flew southward over China, the home of the Chinese. They flew over India, the home of the

Hindus. They flew over Persia, Arabia, and Turkey. They stopped for a while in each of these countries.

In India, which is much farther south than Alaska, the men found the sun hot, and they feared that the terrific heat might damage their engines. The planes therefore carried as little load as possible, so that the overheated engines need not work too hard. Even so, one motor did give out, and the men had to get a new one to carry them on.

About the middle of July the fliers reached the continent of Europe, where they flew over Austria, France, England, and Scotland.

Leaving Scotland, they undertook to cross the Atlantic Ocean in three hops. Their first hop was to carry them to the island of Iceland. Their second hop was to land them on the island of Greenland.

In these northern islands winters are long and cold, just as they are in northern Alaska. Floating about in the ocean near Iceland and Greenland, there are ice floes and icebergs. The ice floes are floating cakes of ice. The icebergs are floating mountains of ice. Some icebergs are thousands of feet long and hundreds of feet high.

In the first chapter we read how one of the planes dropped into the ocean and was wrecked. This happened on the way to Iceland.

When the two remaining planes were flying from Iceland to Greenland, there was a heavy fog over the ocean, and the planes, which had to fly low, were in danger of crashing into

icebergs. Fortunately there was no such collision. The two planes reached Greenland safely.

Back to America

From Greenland the fliers made their third hop across the Atlantic Ocean, this time reaching Canada on the continent of North America. Now the planes were near home.

From Canada the fliers turned their planes southward to the city of Boston on the Atlantic coast of the United States. From Boston they flew still farther south, landing first in New York City and then in the city of Washington in the District of Columbia. Here the President of the United States and the members of Congress came out to the landing field to greet the world fliers as they arrived.

From the city of Washington the planes flew across the United States. They stopped at many cities along the way, and at last they reached Seattle, the city from which they had started.

So the fliers completed their journey. It was the first time that men had succeeded in flying around the world.

Since this first round-the-world flight, other aircraft have flown around the world. The latest flying machines have grown so much safer that today they are used in ordinary traveling. It may well be that many of you who read this book will some day see much of this earth of ours from airplanes.

In Chapter 24 you will read more about airships, dirigibles, and the airports of today.

Things to Do

1. Can you find Alaska on the map of North America?
2. Can you find it on the map of the world?
3. Can you find it on your globe?
4. Trace the route of these airmen from Alaska to Asia. Can you find Japan, India, Turkey, Persia, and Arabia on the map of the world?
5. Can you find Austria, France, England, and Scotland?
6. Trace on your map of the world their route from Scotland to Canada; mark the places where they stopped before reaching Canada.
7. Now perhaps you can trace the entire journey of these airmen, marking on your maps all the places over which they flew.
8. In this chapter you must have learned many new words and phrases. Tell the meaning of each of these words and phrases:

collision	grazing	mountain
iceberg	Eskimo	river
compass	ocean	lake
field glass	island	desert

PART II

WORKING TOGETHER: PAST AND PRESENT

CHAPTER

3. Why the World Works
4. The Earth as a Storehouse
5. The Earth as a Workshop
6. When the Whole World Was a Wilderness
7. How Man Conquered the Wilderness
8. The Nations of the Earth

Chapter 3

WHY THE WORLD WORKS

You read in the last chapter of a famous flight around the world. You remember that the airmen passed over farms where farmers were busy raising foods. They saw grassy plains where cattle and sheep were grazing. They passed over cities where factories with smoking furnaces were busy making many things. They passed over rivers and oceans where boats were carrying people and cargoes of goods to many parts of the world.

All the world was busy working.

What Are Our Needs

At all times, all over the world, people work. On farming lands farmers are busy in their fields. On pasture lands men are raising sheep and cattle. In forests on the sides of mountains men are cutting down trees or hunting wild animals. In city mills and factories men are making things. In city stores and offices they are busy buying and selling. Men are working on trains which cross the lands. On ships at sea, on airplanes high up in the air, even in mines under the earth, men are working. All over the world women are working, too. In homes and schools, on farms, in stores and factories and offices, women work.

Why must men and women work? Of course, we know that people must make a living. But what are the things which people need so that they can live?

We should soon learn what our real needs are if we found ourselves wrecked in a wilderness as two of the fliers were. You remember that one of the planes was destroyed by striking against a mountain on a desolate island near Alaska. For the fliers to have stayed where their plane was wrecked would have meant certain death; so they set out in search of help.

The Needs of the Wrecked Airmen

As the men pushed through the lonely wilderness, what did they need? They needed food. Food satisfied their hunger and kept up their strength. So each day they ate sparingly of their small supply and wondered what they should do if they did not find help before the last of their food was gone.

The fliers needed clothing. Their warm clothing protected them from cold and snow.

The fliers needed shelter. At the end of each day they had to seek a place where they could sleep protected from bad weather and wild animals.

Food, clothes, shelter — these three things the fliers needed. But these were not all their needs. To obtain food, clothes, and shelter, they needed other things.

The airmen needed some means of transportation, or, in other words, some way of carrying things from place to place. As long as their backs would bear up under their

loads, their own bodies were a means of transportation. But if these fliers had had a dog team and a sled, they could have covered ground more swiftly.

The fliers needed some means of communication, or, in other words, some way of sending messages. When people in the same room talk to one another they are communicating, or sending messages, but the messages travel only a few feet. There are times when we need to send messages for many miles. The airmen knew that if only they could let people know what had happened, a rescue party would be sent to their aid.

Meanwhile, the people of the United States were reading the papers anxiously and wondering what fate had befallen the two airmen. A week passed; then the eighth day, the ninth day, and still no word. Every one feared that the men had died.

But on the tenth day the men reached a United States fort where there was a radio station from which they sent word that they were safe.

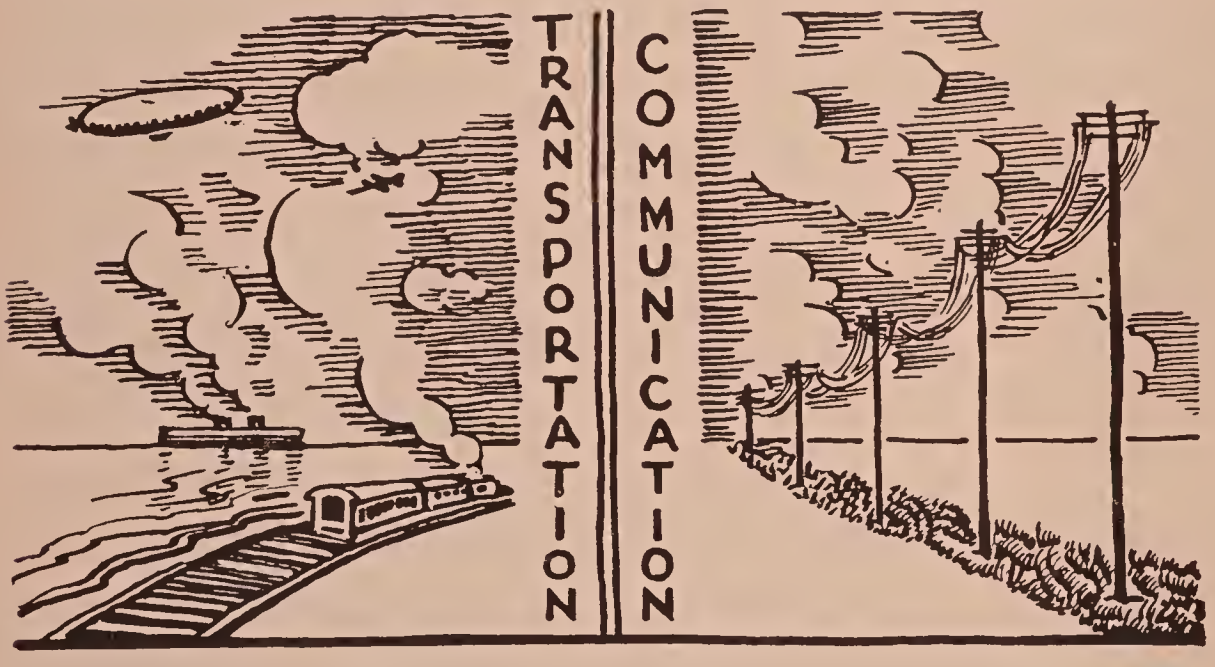
Our Five Great Needs

The adventures of the wrecked airmen proved that they needed food, clothes, shelter, ways of carrying things, and ways of sending messages.

But were they alone in needing these things? No. You need them. All people have these needs, and that is why, all the world over, people are working.

How Men Work to Satisfy Our Needs

Farmers and herdsmen must work to get us food. Lumbermen in the forests must work to get wood for the buildings which shelter us. Workers on trains and ships must carry



food from the farms to feed the people in the cities. They must carry clothes from factories in the cities to supply the people on the farms and in the forests. Telephone operators, telegraph operators, wireless operators, must help in sending messages which go back and forth between city factories

and farms. Men in the post offices are busy receiving and sending letters. Miners deep down in mines must dig out ores which are used in making tools for all the other workers. In other mines men are digging coal to be used to heat our houses and to run machinery in factories.

But what of ministers and priests, teachers, doctors, lawyers, scientists, and other men of learning? What of musicians; people who write stories, poems, and plays; people who paint pictures and make statues? What of baseball players, football players, tennis players, and other athletes?

All these men and women work. Do we say that their work is not needed? No. Men of learning are all workers who may use their learning to help other workers.

Poets, people who paint pictures or write plays, all men and women who work in the arts may help other workers by entertaining them in their hours of rest.

The spirit of sport and athletic play helps to keep people in good cheer.

Now if we think of all the work in which our own friends and relatives are engaged, we can see how many of them are busy trying to supply one or another of our needs.

Things to Do

1. Can you write in a list all the kinds of work mentioned in Chapter 3?

2. Can you mark on the map of the United States the places where some of these kinds of work are being done?

3. Did you get the idea that men and women are doing about the same kinds of work the world over? Tell your class what you know about this.

4. In the list of words below are some that you may not have known before. Will you tell your class what you think these words mean?

transportation	desolate	miners
wilderness	communication	adventures

If you do not remember the meanings of these words, read the chapter again and see if you cannot find their meanings from your reading. Perhaps your classmates or your teacher will help you.

Chapter 4

THE EARTH AS A STOREHOUSE

If we trace back any of the things which workers have made for us, we find that the earth is the storehouse from which we get the things we need.

Let us begin by tracing back the coats we wear. We find that they were bought in the clothing store. The storekeeper bought them from a clothing factory. The factory owner made the coats from woolen cloth which he bought from a woolen mill. The owner of the woolen mill made the cloth from wool which he bought from a herdsman. The herdsman got the wool from his sheep. The sheep obtained its wool by feeding on grass, which is a plant growing from the earth.

The dishes from which we eat were bought in a store. The storekeeper bought them from a pottery, where they were made from a kind of soil called *clay*. The clay the potter used was taken from beds of finely powdered rock in the earth. Have you ever noticed the earthy smell of wet clay?

So we see that the earth has provided us with our coats and our dishes. If we trace back anything else, whether it be an article of food, clothing, or shelter, a means of transportation or of communication, or a tool of any sort, we

shall find that the materials from which it is made come from the earth.

If we think of the earth on which we live as a storehouse, we find that in this storehouse there are three kinds of things: plants, animals, and non-living things called *minerals*. Let us think of these three kinds of things as three departments in nature's storehouse: the mineral department, the plant department, and the animal department. Now, one by one, we shall enter into these three departments to see how we obtain from them the things which we need.

The Mineral Department

The mineral department is a most important department.

By far the greater part of the earth is made up of minerals. The air above the earth, the waters which flow on the surface of the earth, the soil beneath our feet, the rocks, metals, oils, and gas under the soil, are all made of mineral materials.

Let us see some of the ways in which the mineral department supplies man with the material for his food, clothing, shelter, transportation, and communication.

Without the minerals which come in the form of air and water, neither plants nor animals can live. Plants and animals must have air to breathe and water to drink. In some foods, such as apples, tomatoes, and grapes, there is iron. In milk there is calcium and lime. Iron, calcium, and lime are minerals. The body needs these minerals as part of its food. Thus the mineral department helps to feed man. One of the most important minerals which man needs in his food is

salt. Later we shall read how workers obtain the salt which we use as part of our food.

Now let us see whether minerals supply material for making clothing. At first it may seem that this is impossible. We do not wear air or water or rock. But the knights of old did wear suits of iron, and during the recent World War soldiers wore metal helmets. Iron and other metals are, of course, minerals. Should you be surprised if you learned that there are minerals even in the clothes you are wearing? There are. The dyes which were used to put the colors into your clothes were made from minerals.

Next let us consider shelter. Do the workers who build our homes and other buildings use minerals? Have you ever seen a stone house; iron, brass, or copper pipes; iron nails, glass windows, concrete foundations, bricks, cement? Stone, iron, brass, copper, glass, concrete, bricks, cement, are all mineral materials. Take these things out of your school building, and how much of the building have you left?

The iron and copper in your school building are metals which workers obtain from mines. The bricks were made from clay. Glass is made from sand. Cement is made from grinding different kinds of stone to a fine powder; concrete is made by mixing sand, cement, crushed stone, and water. In later chapters we shall learn more about these building materials and how workers obtain them from the earth.

Before leaving the subject of shelter, we might think of a few other minerals used to give us comfort in our homes. The coal, gas, or oil which heat our homes or cook our food

are also minerals which workers obtain for us from the earth.

Clearly, the mineral department in the great storehouse of the earth helps to supply us with food, clothes, and shelter. Likewise, minerals help man in the matter of transportation. You can list for yourselves some of the minerals used in making wagons, automobiles, ships, airplanes, and other vehicles which aid us in transportation. You can readily remember that the coal in the railroad locomotive, the gasoline in the automobile and airplane motor, are minerals.

How about the use of minerals in communication? Remove the copper wires from our telephones and radios and see what happens. Clearly, one mineral at least is most important in communication.

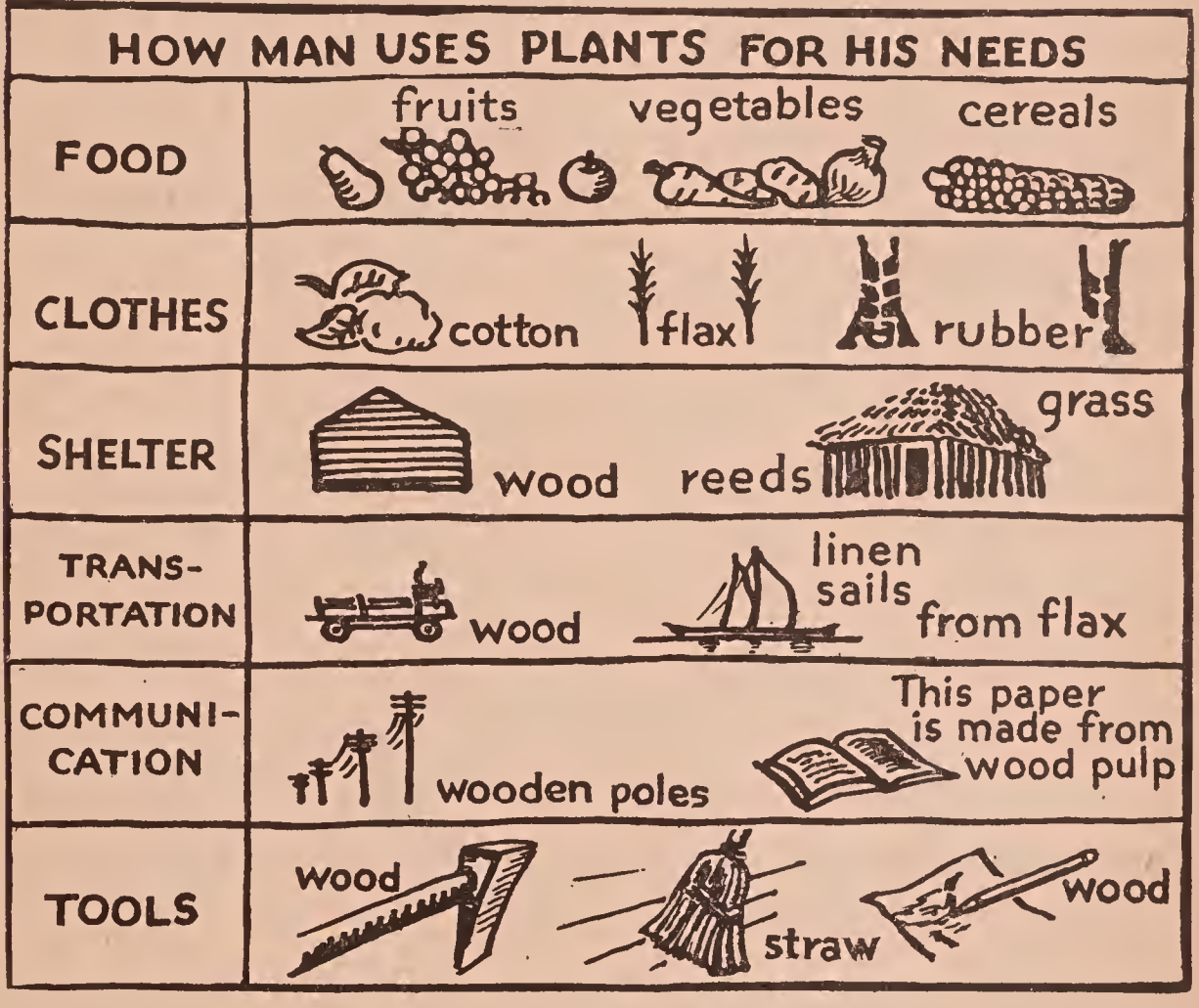
The Plant Department

If we now turn from the mineral to the plant department, we shall find that man uses the plants in nature's storehouse for much of his food, for the material from which he makes his clothing and his shelter. We shall find that man uses materials obtained from plants to aid him even in transportation and communication.

As for food, you yourselves can list at least ten plant foods, including in your list various kinds of fruits, vegetables, and grains, such as apples, cabbages, and wheat.

In the case of clothes you may not be able to list all the clothing materials which man gets from the plant department in nature's storehouse. Let us therefore remind you

that your straw hat, your rubber boots, your linen handkerchief, the cotton in your stockings, were obtained from plants. In Chapter 20 you will read how man learned to use these plant materials in making clothing.



"Very well," you may say, "but how about shelter?" We have just mentioned all the minerals in the home. Are plant materials also used in building? Surely. Wood is still one of the most common building materials, and the wood comes from trees, which are certainly plants.

So, too, plants help man in transportation and communication. There is wood in wagons, buses, railroad cars, ships, and other means of transportation. If we regard books and

writing as a means of communication between people, we discover that here, too, plants are used. The ink with which these words were printed was made of carbon and other minerals; the type and printing presses used in printing this book were made of steel and iron; but this paper page was made from wood pulp, which is a plant material.

By this time you see that we can make a game of searching for ways in which the different departments help to supply man with his needs.

The Animal Department

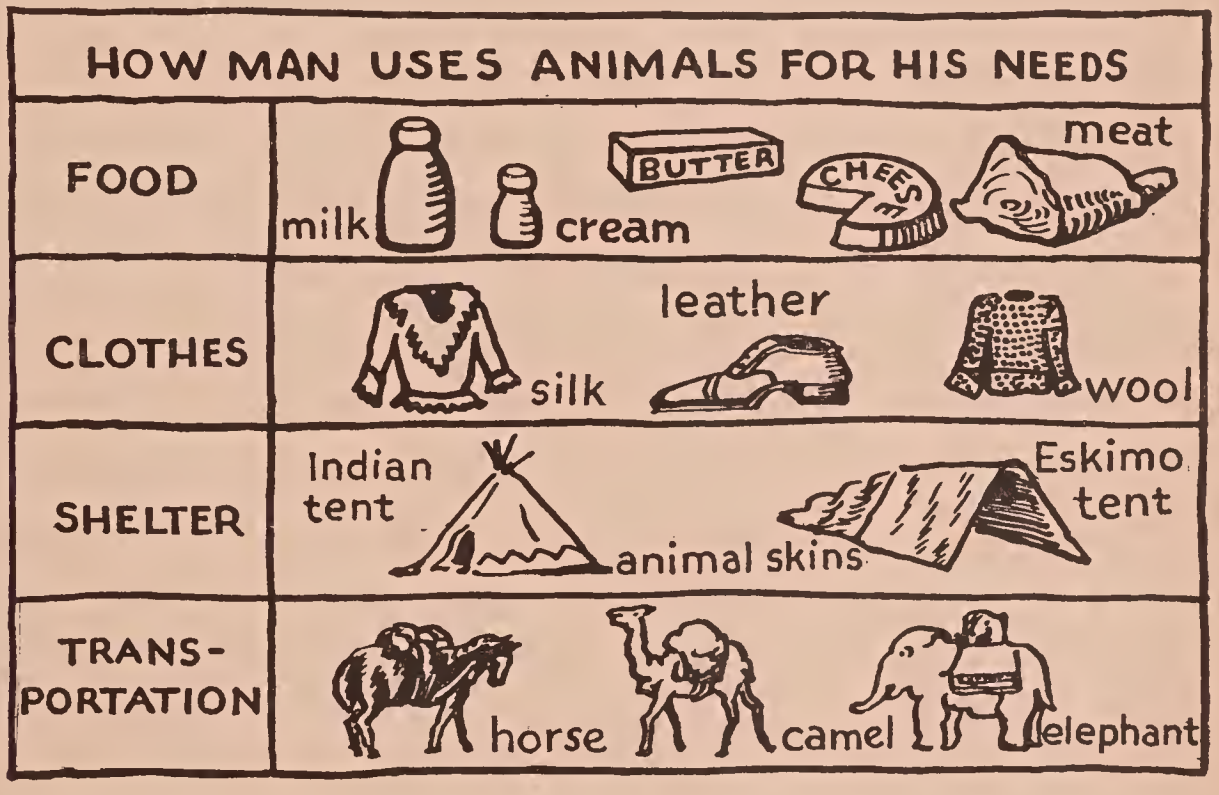
Let us see how man uses animals to supply his needs.

Again we shall begin with food. Here, clearly enough, animals play a leading part. There are some people who eat only plant foods, but many people the world over eat meat and fish. They drink the milk of the cow and other animals, and eat butter and cheese, which are dairy products, or products made from milk. They eat chickens, ducks, geese, and turkeys, and hens' eggs as well.

You could easily have given most of this list of foods yourselves, but can you list all the ways in which animals help to clothe us? Did you know that your leather shoes, your mother's fur coat, your woolen sweater, your silk tie, were all made from materials obtained from the animal department? In Chapters 18 and 19 you will read about furs, leather, wool, and silk, and how animals play their part in clothing the world.

When we come to shelter, it may seem difficult to go on

with the game. But don't give up. You can think of ways in which animals are used to help build homes for people. If you can't, look at the picture chart on this page. It will remind you. In the picture on the row labeled "Shelter," you will see an Indian tepee and an Eskimo summer tent. These tents were made of animal skins; and so it becomes



clear that some people did turn to the animal department in earth's storehouse to find material with which to build their homes.

Next we come to transportation. Do animals help us in transportation? That's an easy question to answer. You can name at least four animals which are used to carry people and goods from place to place: the camel, the elephant, the horse, the donkey.

The next question is difficult. Does the animal depart-

ment furnish materials which aid man in sending messages? Until recently many people used quill pens in writing. A quill is a long, sharp feather of a bird's wing. Many savage tribes use drums or tom-toms for signaling; the heads of the drums are made of animal skins. Glue is an animal material; it is made of hoofs and other meat scraps. There is glue in the binding of this book, and the book is one of the greatest means of communication ever invented.

Speaking of books, did you know that before people learned to print books on paper, they wrote books by hand on parchment? The parchment was made from a material furnished by the animal department. Parchment is prepared sheepskin. Parchment is still used. Some day if you go to college, you will receive a diploma announcing that you have completed your course. Your diploma probably will be made of parchment. When you receive it, let it remind you that in one more way the earth, which is the storehouse of our needs, is serving you.

Things to Do

1. Either draw or cut out of a newspaper or magazine a picture of an automobile. Show by arrows and printed lettering which parts of the car came from the animal department, which from the plant department, and which from the mineral department.

2. See whether you can trace back to the different departments in the storehouse of the earth all the materials in this book, including the book linen used in the cover, the glue used in binding the paper, the ink, the metal plates from which the illustrations were made.

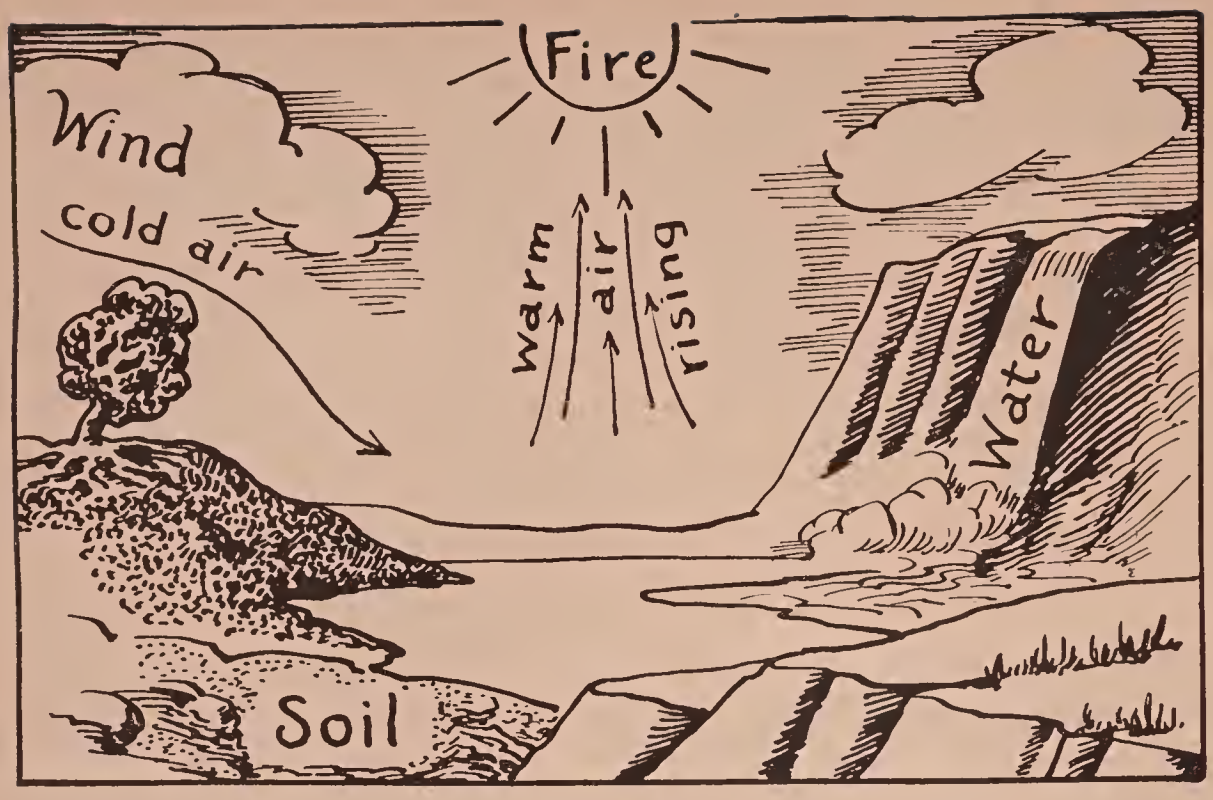
3. Make a chart divided into three columns as follows:

BUILDING MATERIALS

Mineral	Animal	Plant

Then write in each column the name of building materials which come from that department.

4. Play a game to be called "The Earth's Storehouse." Divide the class into three groups. The first group conducts the mineral department; the second group, the plant department; the third group, the animal department. We feel sure that with this hint, you can work out a game which will make clear how each department in the earth's storehouse supplies people with things which they need. You can, if you wish, have the teacher play in the game. The teacher could say, "I need food." Then some one in each department could offer food. The teacher could say, "I need clothes." Then some one in each department could offer a material which could make clothes, and so on.



Chapter 5

THE EARTH AS A WORKSHOP

When we step into a department store we can look at it as either one of two things. We can see it as a storehouse from which people buy the things they need, or we can see it as a workplace in which salespeople, section managers, shipping clerks, window dressers, and other workers are all busy at their various tasks.

We can, if we choose, look at the earth in either one of these two ways. We have just read about the world as a storehouse, with its various departments each helping to supply our needs. In this chapter we shall consider the world as a workshop in which forces of nature are at work.

The three forces of nature which we shall consider in this chapter are fire, wind, and water.

In our chapter on "Why the World Works" we found that all over the world people are working, and that they are working to supply us with the things we need. Now we shall see how all over the world the forces of nature are also at work.

Fire and the Sun

The first force of nature which we shall consider is the force of fire which comes to the earth in the form of heat from the sun. This heat from the burning sun is constantly doing things in nature's workshop.

The sun's heat is at work in all living things. Whether they are plants, animals, or human beings, all living things are factories run by the heat of the sun.

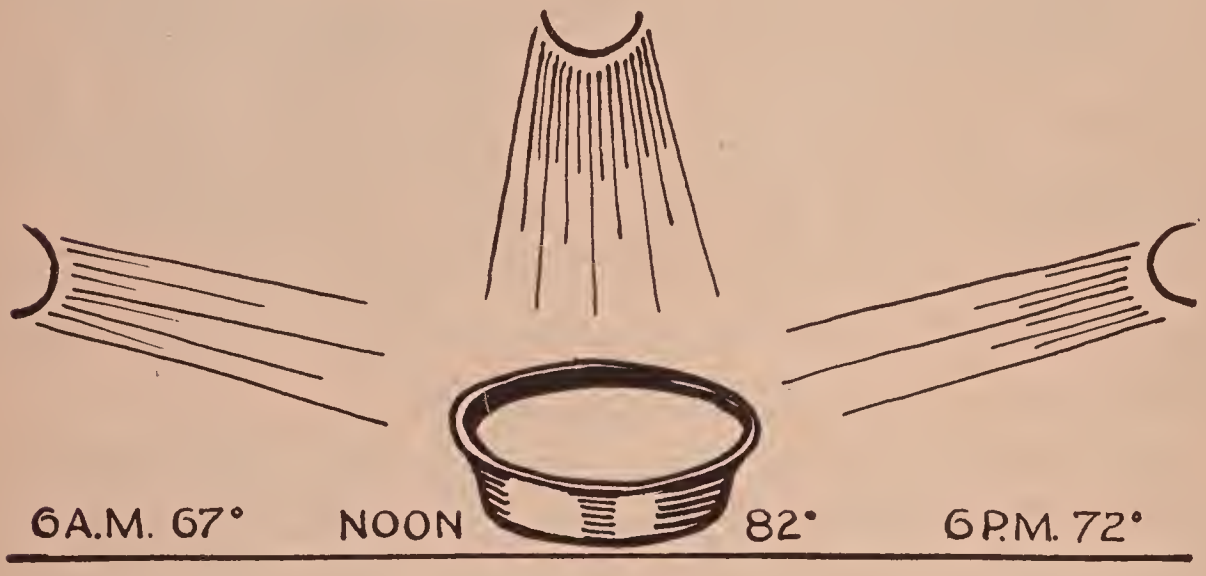
Look at a growing plant. Does it look like a factory? Hardly. Yet a plant is a factory. Its leaves, its roots, its stems, are all busy working to change air, water, and the mineral materials of the earth into plant materials.

Plant a bean in a pot of good soil; place the pot in a sunny place; water it daily, and in a few days the seed will sprout. Soon roots, stem, and leaves will appear. In a few weeks beans will grow on the plant. During those weeks work was going on inside the plant, just as work goes on inside a factory. The plant manufactured beans.

Plant a second bean in a pot of good soil, and place the pot in a cold, dark place. Water it daily. Watch it for weeks. The bean may sprout, but the plant will not grow. No beans will be manufactured. Why? Because the plant factory needed the fire of the sun to help it in its work.

All living things need the force of fire, which comes in the form of the sun's heat. Without the heat from the sun, the work which is going on in all living things would stop; plants, animals, and human beings would die.

Our experiment with the beans has shown us one way in which the force of fire is at work in nature's workshop. The



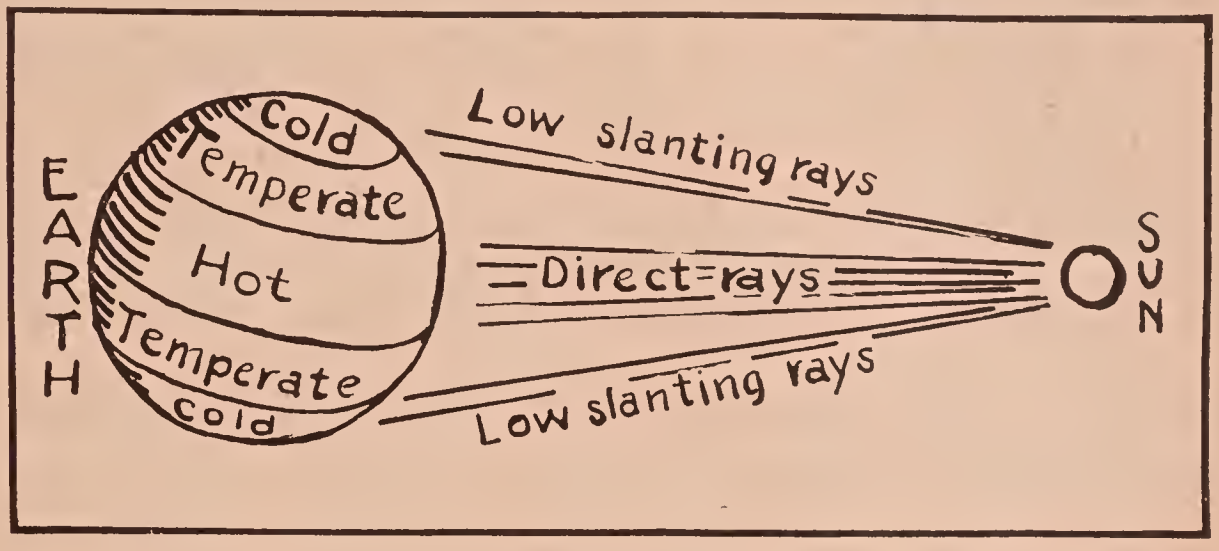
heat given off from the burning sun helps all living things to grow.

There is a second way in which the force of fire is at work in nature. The sun is the great climate maker. The heat from the sun warms the earth; the heat from the sun warms the waters which are on the face of the earth. All day long the sun is heating earth and water.

Because the earth is shaped like a ball, the sun does not heat all parts of the earth equally. Set a pan of water out in the open, and test its temperature with a thermometer in the early morning, at noon, and in the evening. See how much warmer the pan is at noon. When the sun is overhead

and shines directly down on the water, the fire in the sun can heat the water easily. When the sun is low and its rays shine on the pan at a low angle, the fire in the sun cannot heat the water so easily.

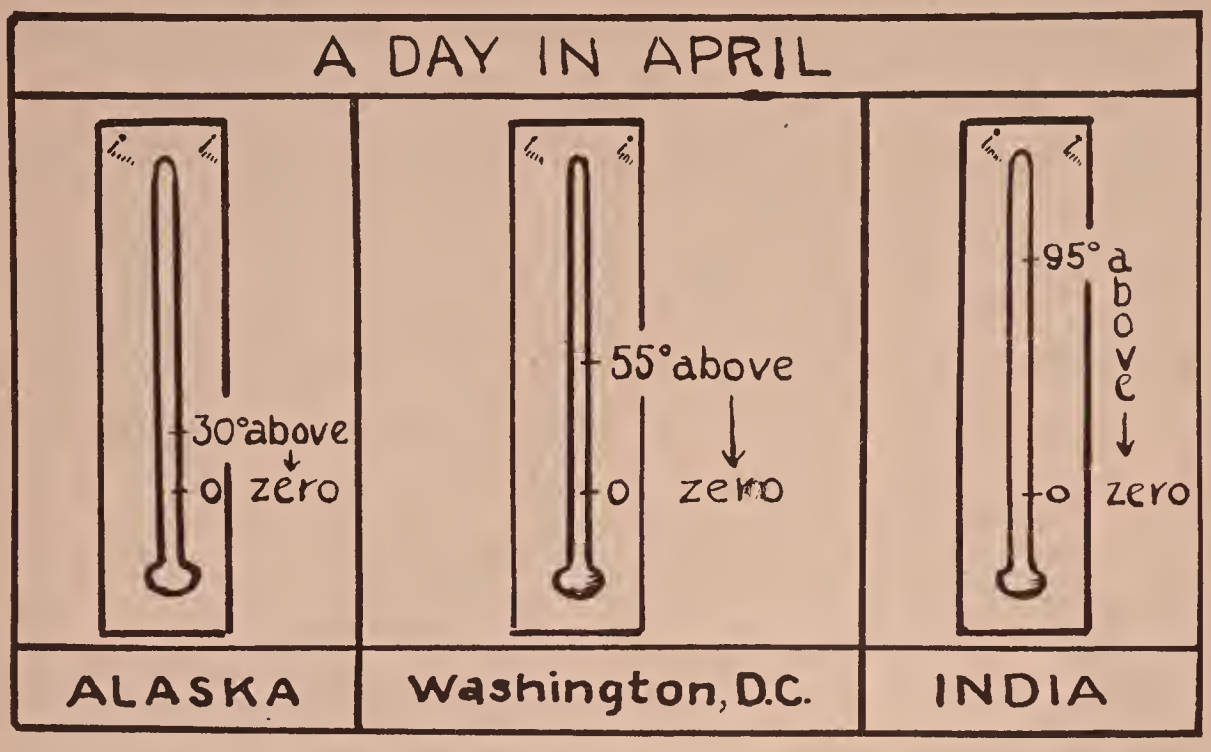
So it is with the sun and the earth. In parts of the world where the sun's rays shine directly on the earth, the climate



is hot. That is why the airmen found India hot. In parts of the earth where the sun's rays shine on the earth less directly, the fire in the sun heats the earth less. That is why the airmen found cold weather in Alaska, Greenland, and Iceland.

It is for this same reason, as we learned from our pan of water, that the weather in any one place may grow hotter or colder as the sun rises higher or sinks lower.

We know, too, that the weather in any one place changes from day to day according to the seasons. This is because the sun shines on the same parts of the earth at different angles at different times of the year. In those months of the year when the sun shines on your home most directly, it is



summer. In those months when the sun shines on your home least directly, it is winter.

The Sun and the Force of the Winds

We have learned how the sun heats the earth. To learn how the work of the sun helps cool the earth, we shall now read about the sun and the winds.

The sun creates the winds which cool the earth. You may ask, "But how does the sun, which is hot, create winds, which are cool?" Let us see.

As the sun heats the earth, the hot earth in turn heats the air. When air gets warm, it rises, just as smoke rises out of chimneys and smokestacks. When the heated air above some warm place rises, cooler air from some other spot rushes in to fill its place. So we get a movement of air upward as well as from the south, the north, the east, and the west. A

wind from the south is called a south wind; a wind from the north is called a north wind. Winds from the east and west are called east and west winds.

A breeze is a gently moving flow of cool air. A wind is a swiftly moving flow of air.

The heat from the fiery sun starts winds on their way. Once they are blowing, the winds perform their own work in nature's workshop.

Can you think of any of the work performed by winds? Watch the clouds moving up above. What drives them through the air? You are right. The winds. What other work do the winds perform? Winds help to change the weather. Warm winds may bring rain; cold winds may bring snow. Summer breezes help to cool plants, and so save them from burning up in the heat of the sun.

Winds carry the seeds of plants and scatter them. That is how the wild forests, the wild fruits and berries, spread over the face of the earth.

The Force of Water

So far we have considered the work of fire and wind. Now let us see the work of a third force in nature, the force of water.

The fire of the sun heats the air and starts currents of wind on their way. The fire of the sun heats water, which is all over the surface of the earth, in the soil as well as in rivers, lakes, and oceans. The heat of the sun changes water to vapor, which rises in the air and forms clouds. Winds drive

the clouds. Later, the water in the clouds falls as rain, snow, or sleet. In Chapter 16 you will read more about the way in which the sun and air change water to vapor. You will read about the journey of a drop of water in a cloud from the ocean to our drinking cup. Here we shall study only how water works after it has fallen as rain.

As you know, the surface of the earth is not even. The fliers in their trip around the world saw level country, valleys, hills, and mountains. The water which falls on level country sinks into the earth. What happens to the water which falls on the hills and mountains? Some of this water also sinks into the earth. The rest flows downward in brooks and rivulets. Wherever the earth slopes gently, the water moves slowly. Where the earth slopes sharply, the water moves rapidly. We call such a place *rapids*. When water flows over a cliff, there is a *waterfall*.

Whether the water is flowing on the earth or underground, moving swiftly or slowly, it is working in many ways. On mountain sides forests may have been growing for centuries. The fallen leaves, decaying on the ground, make the soil rich. Plants grow well in such topsoil. The water carries this rich topsoil down from the mountains into the valleys. It is because of this topsoil that many river valleys make good farming country.

On its downward course the flowing water does other work. The water wears away the banks of streams on either side. Swiftly flowing water carries small rocks down with it. The water flowing over and around rocks shapes them, rounding

them. In cold countries water lying in the roughly grained rock freezes in winter. As the water turns to ice, it expands and grows larger. If there is no room for the water to expand, the ice, as it forms, splits off pieces of rock.

Water works on rock even under the surface of the earth. The water which trickles down through the soil finally reaches rock. When it does, the water flows downward along the rock. The action of the moving water wears away the rock and changes it to soil.

The most wonderful example of the force of water is the Grand Canyon in Colorado, where the Colorado River has worn a deep path through miles of rocky cliffs.

We must not forget an important work which water performs. All plants and animals would die without water; they need water to help keep them cool. They also need water to help them dissolve the minerals which they need for their food.

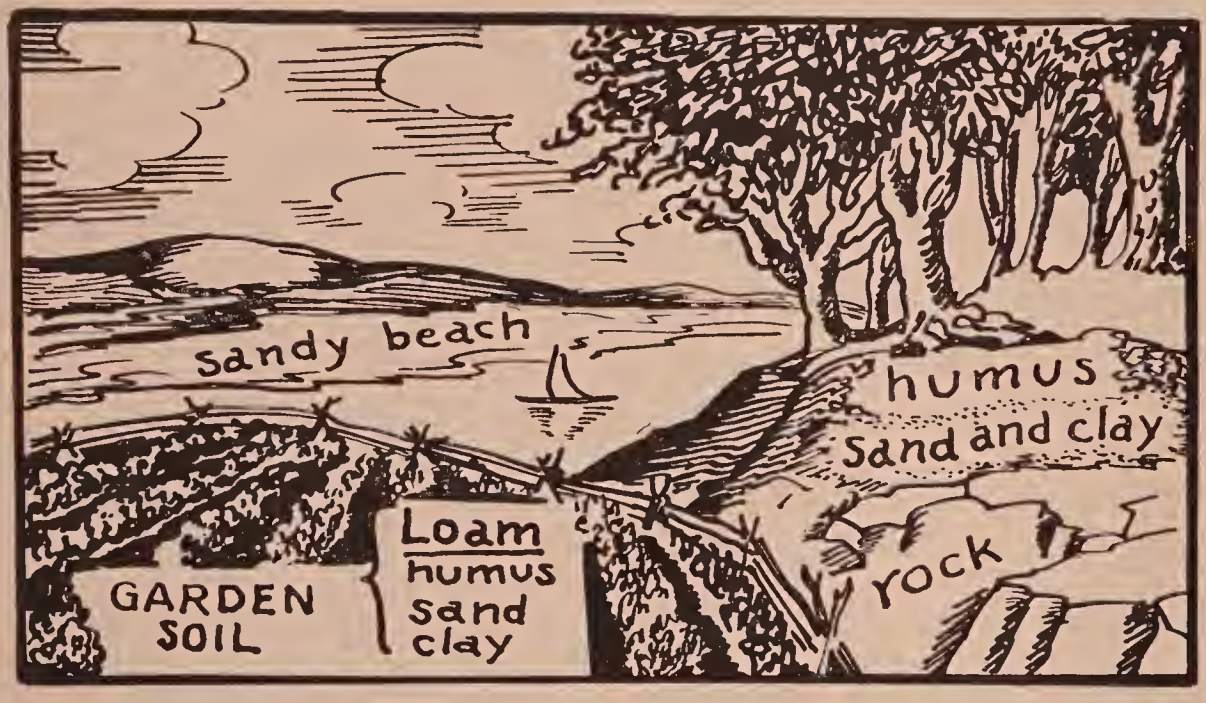
In order to see more clearly how important water is in the growth of plants, let us perform another experiment.

Fill two small flowerpots with good garden soil. Plant a bean in each. Place both pots in the sun. Water one pot immediately after planting; continue to water it, adding a cup of water once a day toward evening. Do not water the other pot. In time a plant will grow out of the bean in the well-watered pot. The bean in the other pot may sprout from the water which was in the earth; but without additional water, it will not grow. Clearly, the water in the first pot worked to aid in the growth of the plant and the produc-

tion of the beans. From this experiment we can see why farming lands are found wherever there is much rain as well as plenty of the sun's heat; and why there are deserts wherever there is burning sunlight without much water.

The Soil

Now let us turn to study the soil, a most important material in earth's workshop.



Let us examine the soil to see what it is made of and what part it plays in nature's workshop. We shall study the soil, not in the flowerpot, but out in the woods.

When you walk in the woods, you will find that much of the topsoil is loose and dark brown or almost black in color. This rich soil is called *humus*. Humus is soil which contains decayed plant and animal matter, such as dead leaves and insects. Humus makes good food for growing plants.

If you now take a shovel and dig deep enough below the

humus, you will come to *bed rock*, as it is called. If you dig down anywhere on the surface of the earth, sooner or later you will come to bed rock.

As you are digging down toward the bed rock of the earth, you may see some round stones. You will know from their round faces that these stones once lay in the beds of streams where running water smoothed off their rough edges. You may see layers of shale, a stone which has been made crumbly by the force of underground water. You will find rough stones hard as iron; yet if you put one of these in a glass of water, you will notice that there will soon be a layer of sand at the bottom of the glass. Where does this sand come from? It comes from the surface of the rock which has been slowly crumbling, as heat, wind, and water work upon it to break it down.

At first, before there were plants and animals on the earth, all the soil was rock. But in time the action of heat, wind, and water, as well as other forces, broke down much of the rock into sand, silt, clay, and gravel.

Gravel is the coarsest form of soil. It is a mixture of sand and pebbles.

Sand is the form of soil next in coarseness. It is easy to work, but so loose that water can wash all humus out of it. It dries out quickly. Some plants are started in sand because it is easy to work, and then transplanted to other soil which has more humus in it.

Silt is a still finer soil.

Clay is the finest soil. It is sticky when wet, and almost as

hard as rock when dry. It is a heavy soil, and holds water a long time. It is stiff and hard to work. Roots cannot go very deep into a clayey soil, but grass grows well in such soil.

The best soil for most garden vegetables, grains, and fruits is *loam*, which is a mixture of sand, clay, and humus. Loam is a fertile soil because it helps the plant factory to get air, food, and water. The sand keeps the soil loose so that air can get to the roots. The clay holds moisture. The humus helps to feed the plants.

When a crop is growing, it is using up the humus in the soil. Before the farmer plants again, he may have to use a fertilizer to put back into the soil a fresh supply of the plant foods which humus contains.

You could not live by going out into your garden and eating the soil, but a plant can eat soil. As the plant grows from the soil, it can furnish you and your family with meat and potatoes, bread, and butter. Green plants are often called the food-makers of the world, since upon them depends the food of all animals and human beings.

We have told many things about the work of fire, wind, and water, and yet we have not half told all the work that these three forces are doing in nature's workshop. We have not told all, but we have told enough to help you understand, as you read on, how the work of nature, joined to the work of man, aids in supplying us with the things we need.

In the largest sense of the word *home*, the earth is our home — the whole earth with the skies above our head and

the soil beneath our feet. So far in this book you have read many things about this earth of ours, but most of us today live in cities where we are likely to think little about the earth and the ways in which we get things from it. In the next chapter we shall read about a time when all the people in the world lived so close to the earth that men, women, and children obtained all the things they needed directly from the earth.

Things to Do

1. The class should get a thermometer, learn how to read it, and keep it in some suitable outdoor place. Make a class chart on which the class can keep a daily record of the outdoor temperature at different times of the day, all through the term. See what you can learn from this chart about some of the work of the sun, from hour to hour, and from season to season.

Date	9 A.M.	Noon	3 P.M.

2. Make a chart to keep a record of the winds. See whether you can find that winds from any one direction usually bring rain or snow.

Date	9 A.M.	Noon	3 P.M.	Rain or Snow (hour)

3. Describe an apple tree as a factory which makes apples. Explain as best you can how the heat of the sun, the wind, and water all help this factory to produce apples.

4. You can invent a game or play in which Fire, Wind, and Water tell of the work they do in nature's workshop.

5. An interesting thing to do would be to go into the country to look for as many signs as you can find of the work which the sun, wind, and water are doing.

6. On that trip you can collect examples of different kinds of soil; you can also collect rocks which show the action of water.

Chapter 6

WHEN THE WHOLE WORLD WAS A WILDERNESS

In the spring we all like to go walking in the woods to see the wild flowers. No gardener planted the seeds of these flowers in the woods. But when the ice and snow have left the northern hills and valleys, these wild plants push their way upward through the soil and are soon in blossom.

Sometimes as we walk through the woods, we startle a rabbit along our path. Does any one own that rabbit? No. It is a wild creature and belongs to no one.

Wilderness Places Today

There are some places in the world where almost all plants grow wild, as do the flowers we see in the woods; where all the animals are as wild and untamed as that rabbit.

We call a place where the plants and animals grow wild, a *wilderness*. In the cold northern countries, such as Iceland and Greenland, most of the land is wilderness. The few plants which grow are wild plants. Except for the Eskimo dog and the reindeer, the animals are wild animals. These northern countries where it is cold almost all the year round are called the *Arctic* countries. Seals, white bears, walrus, and caribou are some of the Arctic wild animals.

In India, where the climate is hot all the year round, much of the land is wilderness.

If we look at a globe, we shall see a line running around it from east to west and back again. This line is called the *equator*. The countries which lie near the equator are called *tropical* countries.

A wilderness in a tropical country is usually a jungle. In a jungle the trees grow thickly and a rich vegetation of all kinds covers the earth. This heavy growth is due to the great heat of the sun and the frequent rains. Because of the dense growth, jungles are almost impassable.

In the jungles there are many wild animals, such as the tiger, the lion, the leopard, and the jaguar. There is a great variety of brightly colored birds. There are also many poisonous snakes. Hunters have brought back many of these jungle creatures which one can see if one visits a zoo or a circus.

There was a time within the memory of our grandparents when the country not far from our own homes was as wild as the Arctic countries or the tropical jungles are today.

There was a time many thousands of years ago when the whole world was a wilderness in which all plants grew wild and all animals were wild creatures.

How did the people who lived in the wilderness of long ago get what they needed?

Cave Dwellers: Life in the Wilderness Long Ago

Scientists have found out how some early wilderness dwellers found shelter. In different parts of the world caves have been found which are thousands of years old. In the earth of these caves scientists have found stone tools which must have been made by men. In this way we know that caves were the shelters of men and women and children who lived long before any one thought of building houses.

For food the women who lived in those days gathered berries and fruits of different kinds, wild grains, nuts, and the roots of plants. The men hunted for wild animals.

When the boys grew up, they became hunters. The girls learned from their mothers to gather wild plant foods. They also helped their mothers make clothes from animal skins. We can easily imagine how busy these people must have been, for all the day they were occupied with making, gathering, or hunting the things that they needed in their daily life. When night set in and the woods resounded with the howling of animals, these people must have been glad to creep into their cave shelters for their night's sleep.

Questions to Answer

1. What is a wilderness? Find the sentence on page 45 which tells you what a wilderness is.
2. Did you find out from reading this chapter where there are places like those described?
3. Do you think that India today is entirely a wilderness? Are there any large cities in India?
4. What other countries are named in this chapter?

Things to Do

1. Find on your maps and globes all the places mentioned in this chapter.

2. Write a list in your notebook of the names of all the wild animals mentioned in this chapter.

3. Perhaps you can bring pictures of them to show to your class.

4. If there is a zoo near your home, perhaps you will want to visit it and see some of these wild animals.

5. You might like to draw pictures of them.

6. Copy the list of words below, then write the meaning of each word on the line opposite.

jungle _____
blossom _____
cave _____
tropical _____
creatures _____

7. Add to your list other words you find in this chapter which you would like to remember the meaning of.

Chapter 7

HOW MAN CONQUERED THE WILDERNESS

In this chapter we shall read how inventors helped man in the conquest of the wilderness.

For a long time the whole world was a wilderness in which many people lived by hunting. While some hunters were still hunting for game, there were men who lived as herdsmen on the pasture plains where sheep and cattle grazed.

The grass-eating animals were gentle, and the herdsmen killed them only when they needed meat. Whenever the herds were moved to new pastures in search of grass and water, the herdsmen and their families had to follow. So they became wanderers, or nomads, following the herds of grazing animals and dwelling in tents which they carried with them from place to place.

How Early Farmers Fought the Wilderness

Some of the hunters and herdsmen learned that by planting seed in good earth, they could raise wheat and other grains. No one knows how men first discovered this. But when men learned how to raise plants from seed, they also learned that they must stay in one place to watch and take care of their crops. So men settled down to till the soil and live as farmers.

More than seven thousand years ago there were farmers

in the land of Egypt. Egypt is a country in northern Africa. The Nile River, which flows through the land of Egypt, overflows its banks once a year, spreading a rich topsoil over the fields. This topsoil helps to make the land fertile. It is easy to grow crops in Egypt.

In Egypt long ago farmers built their houses near their fields of grain. These houses stood close together in small villages. A few of these villages grew into towns.

When the Nile River overflows its banks, much of Egypt along the river is like a great sea. People, in those early days, were in danger of losing their homes, their animals, and their own lives in the flood. The water had to be controlled. Their homes and lands had to be saved.

To save their houses and lands, the early farmers of Egypt had to build great dikes and small islands where they could stay during the late summer months while the river was overflowing.

Such a piece of work needed great numbers of people. No one man or his family could do this work alone. People had to call upon their neighbors for help.

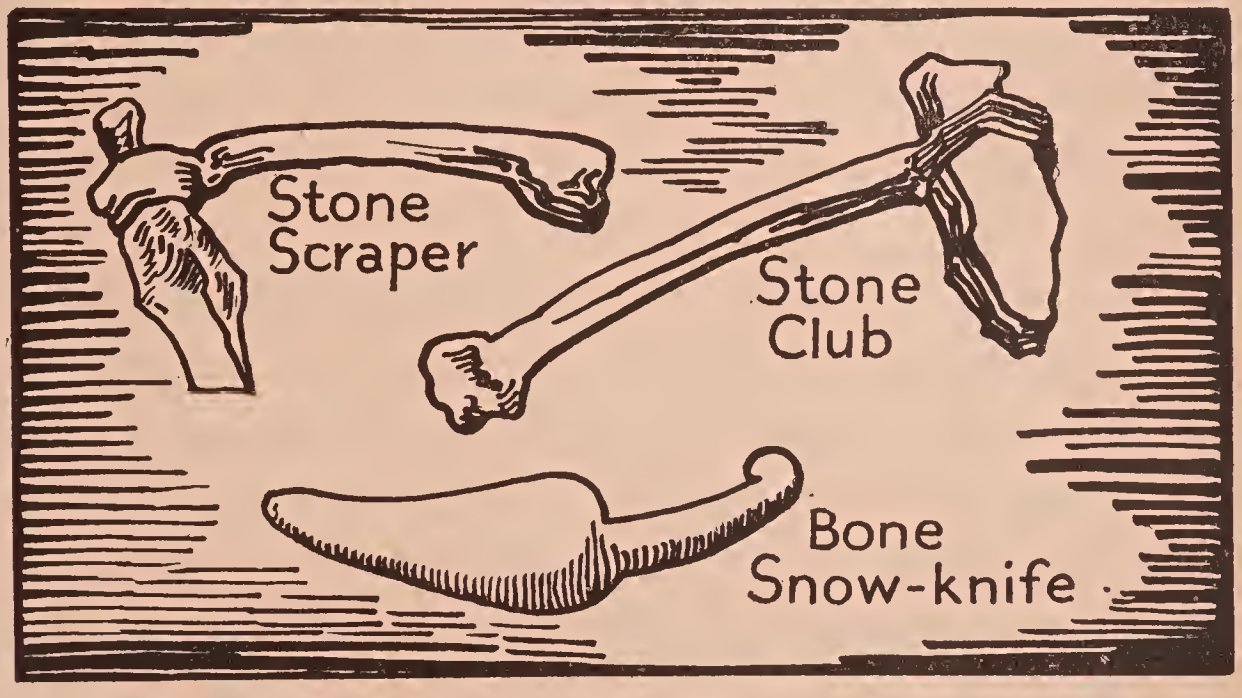
So because of the dangerous floods, the Egyptian farmers and villagers learned to join forces with one another and to work together. After a time all the farmers, villagers, and townsmen in the land were joined together as one nation under one strong ruler and one set of laws.

It took many, many years for Egypt to grow into a nation from such small beginnings. But it grew into a powerful nation, the oldest in the world.

After Egypt became a nation, slowly the hunters and the herdsmen in other lands gave up their old life. They cleared the forests for farming; they built villages and towns.

Man the Inventor and Tool-Maker

Man never could have conquered the wilderness had he not been an inventor.



The Eskimos Used Simple Tools

The early wilderness dwellers had learned how to make tools out of wood, stone, and bone. Out of wood they made clubs, daggers, and arrows. Out of hard stone they made hammers, knives, and axes. These tools not only helped in doing work, but they also helped in fighting fierce and dangerous animals.

After a time people learned how to make woolen cloth on hand looms. Women were the first spinners and weavers.

They made the first baskets, and some say they discovered the making of pottery. Later you will learn how important these discoveries are to us today.

Fire is one of the greatest forces which man ever learned to use. No one knows how he discovered it. It sometimes happens that a tree struck by lightning takes fire and burns for days. In some parts of the world there are *volcanoes*. These are mountains in which fires burn. At times these fires burst out of the mountain tops, and streams of *lava*, or burning rock, flow down the mountain sides, setting fire to the forests.

How Fire Helped in Conquering the Wilderness

For ages the sight of fire must have terrified man, but the time came when people learned to make fire serve them. They learned how to keep a fire burning by piling fresh fuel on the blazing logs. As the flames blazed up, the firemakers fed the fire. Later men learned how to start fires themselves by rubbing two stones or two pieces of wood together.

With fire, people baked their clay pots. The fire cooked their meats. It helped to warm them through the cold winters.

Watching their outdoor fires, people noticed that heat melted some of the earth's substances. One substance which they saw melted by fire was copper.

When copper or any other metal is melted, it can be poured into a mold of any shape; and as it cools it hardens in the shape of the mold. With this knowledge, men became metal

workers. They made hammers, axes, knives, swords, daggers, and other metal tools.

The metal workers of Egypt learned the art of making tools, first from copper; then from bronze, which is copper mixed with tin; then from iron. Metal axes helped men to clear the wild forests. With metal axes they cut wood and built themselves wooden ships. Then they put sails on their ships, so that the winds would carry them more swiftly across the waters.

How the Wind Helped in Conquering the Wilderness

From this time on, the wind as well as fire helped man in conquering the wilderness.

At first the Egyptian boats sailed only on the Nile River. Then Egyptian boats, and boats built by other peoples, sailed out on the Mediterranean Sea, which lies between Europe and Africa. These boats carried the knowledge of farming and town-building to the hunters and herdsmen in Europe.

For thousands of years the people of Europe were busy taming their own wild lands by turning them into farms and towns and nations. So England, France, Spain, and the other nations of Europe came to be. Each nation lived under its own ruler and had its own laws.

Finding the New World Wilderness

Then in the year 1492, a sailor named Christopher Columbus led a fleet of three sailboats westward across the Atlantic.

The fleet which Columbus commanded discovered a new world, America, where the Indians lived.

A great part of America was still an untamed wilderness in which Indian tribes obtained most of their food by hunting.

In a few years many boats from Europe were crossing the Atlantic Ocean. They were carrying European men, women, and children, who were coming to the American wilderness to live. They were bringing with them the seeds and the metal tools which they had learned to use in Europe. They were bringing sheep, cattle, and other tame animals which they had raised in Europe.

Conquering the New Wilderness

In America these people used their metal axes to chop down the wild forests, to clear farms, and to build towns in the part of the country which lies near the Atlantic Ocean.

From early colonial days until about one hundred and fifty years ago, the farmers and the townspeople who lived in our country had to obey kings and laws made in England. Then they fought a war which freed them from the rule of England, and they formed themselves into a separate nation, the United States of America.

Later, when more and more people came from Europe, many men and their families put their household goods, seed, and farming tools into covered wagons, and set out to conquer the wilderness in the western part of the American country. Still a large part of America remained wilderness,

especially the part of our country which lies west of the Mississippi River.

New Tools Help to Build the American Nation

About one hundred years ago men discovered the use of steam power, and so were able to invent new means of transportation. They invented steamships to sail upon the American waters and steam locomotives which helped to carry great numbers of men and women across the American continent. All along the way the newcomers in the West turned the wilderness into good farms, thriving villages, towns, and cities. They helped to build new states which joined with the other states in the United States of America.

So far, in their fight against the wilderness, men had been aided by fire, wind, and steam power. Now men learned to use a strange new force called *electricity*. Some men invented the telephone, the telegraph, the cable, the wireless, the radio, and the gasoline motor which made the automobile and the airplane possible.

The inventions which use electricity are aiding in the further conquest of the wildernesses which are still to be found in various parts of the earth.

Today the radio and the airplane are being used by explorers who are pushing their way into the portions of the earth as yet untamed. Did you read of the use of the airplane and the radio in a recent exploration of the South Pole?

Questions to Answer

1. Where did these early peoples live?
2. Why were they called Nomads?
3. What caused them to change their way of living?

Things to Do

1. Find the locations on your maps and globes of the homes of these early peoples.
2. Draw a map showing these locations.
3. Describe the life of a cave man, of an ancient herdsman, of an ancient farmer.
4. Write or tell the story of ancient man which you learned in this chapter.
5. The words below tell something about ways of living and working; write the meanings of these words:

primitive	farmers
cave men	villagers
hunters	townspeople
herdsmen	rulers
till	looms
mold	colonial

Chapter 8

THE NATIONS OF THE EARTH

We who live in the United States today live either on farms or in villages or in towns or in cities. More than one-half of us live in towns and cities. The others live on farms or in villages.

Do the people in all other lands live as we do?

No. The conquest of the wilderness and the building of nations has not gone on equally in all lands.

Life in the Wilderness Lands

In the tropical countries there is still much wilderness, because the warm climate and the rapid growth of vegetation make it hard to keep the jungles clear for farming. In the jungle people build no cities; they do not band together as great nations.

In the Arctic countries in many places the land is too cold for farming, except for a short time each year. So here, too, the land is mostly wilderness and people live for the most part by hunting and fishing. The men sometimes hunt in small bands, but the Arctic dwellers have not united to form great nations.

If we look at the under side of our globes, we shall find the Antarctic lands. Here, as in the Arctic lands, the winters are

long and cold. The Antarctic lands are still wilderness, and there are no Antarctic nations.

Strong Nations in the Temperate Zones

Where are the nations of today? Let us see. Between the Arctic lands and the tropics there is a part of the world called the North Temperate Zone. Between the Antarctic lands and the tropics lies the South Temperate Zone. This makes five zones or belts around the earth — the Arctic, the North Temperate, the Tropical, the South Temperate, and the Antarctic.

In the two temperate zones, the climate is neither too hot nor too cold. Each year there are four seasons: spring, summer, autumn, and winter. During the spring people plant their seed. It grows through the spring and summer. In the fall farmers gather their harvest.

The strongest nations in the world today are the United States in North America; England, France, Italy, and the other countries in Europe; Japan in Asia. These lie within the North Temperate Zone.

How Work Today Is Divided: Farms, Cities, Nations

Long ago when the whole world was a wilderness and there were no farms or cities, men obtained all the things which they needed from the earth through their own work. Ever since people have been living on farms and in cities, work has been divided. Farmers raise food for themselves and for the

city dwellers. The workers in the city factories make things for the farmers.

In our own country, because of new tools invented within the last hundred years, the work of the farms and cities is becoming more divided than ever. Most of the farmers and the city workers of today use the new tools to work at just one thing. There are farmers, for example, who raise only wheat. There are city workers who make only shoes or some one part of a shoe.

Almost everything which the farmers and city workers need comes to them through the labor of people whom they have never met, living in places which they have never seen.

So the work of the whole world is divided. Each country is busy making the things which it can make best and exchanging its goods for those made by some other country. Railroads, steamships, airplanes, telegraphs, and telephones are helping in the exchange of goods through all parts of the world. No matter how many miles separate us from other people, we no longer live apart. The people of all nations need one another.

To Understand the Work of the World, Read On!

We are living in an interesting time, but because work is so divided between city and country, between nation and nation, few of us see with our own eyes how the earth provides the things we need, and how the workers prepare these things for our use. The rest of this book will tell you more about the world of today, so that you will see in your mind's

eye how man's present ways of doing things grew out of the past, how people live, and how they work to obtain from the earth the things which they need.

Questions to Answer

1. What is a tropical country?
2. What nations of the earth lie in the tropical regions?
3. Where are the temperate zones?
4. Which of the zones do you live in?
5. Name the strongest nations of the world.
6. Find them on the map of the world and on the globe.
7. What does it mean to 'exchange goods'?
8. Tell in your own words what you learned in this chapter.

PART III

FEEDING THE WORLD

CHAPTER

9. Why We Need Food
10. How We Get Our Meat
11. Milk, Cream, Butter, and Cheese
12. Poultry and Eggs
13. Food from the Sea
14. Wheat and Other Grains
15. A Basket of Plant Foods
16. Water and Salt

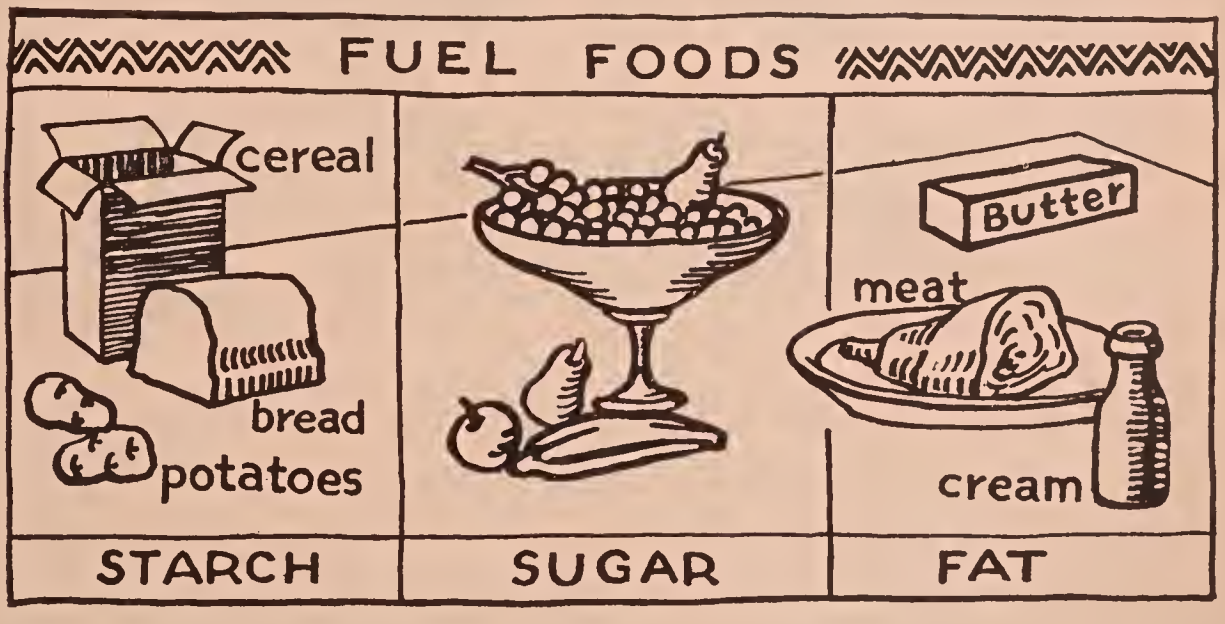
Chapter 9

WHY WE NEED FOOD

Every day, in the morning, at noon, and in the evening, we eat. We are hungry, and we must eat because our bodies need food.

But why do our bodies need food?

One reason is that food is fuel for our bodies, which are like engines. Day and night our hearts beat like pumps.



Our lungs draw in air and then force it out again. During the day we run, we pull things, we carry things, we study.

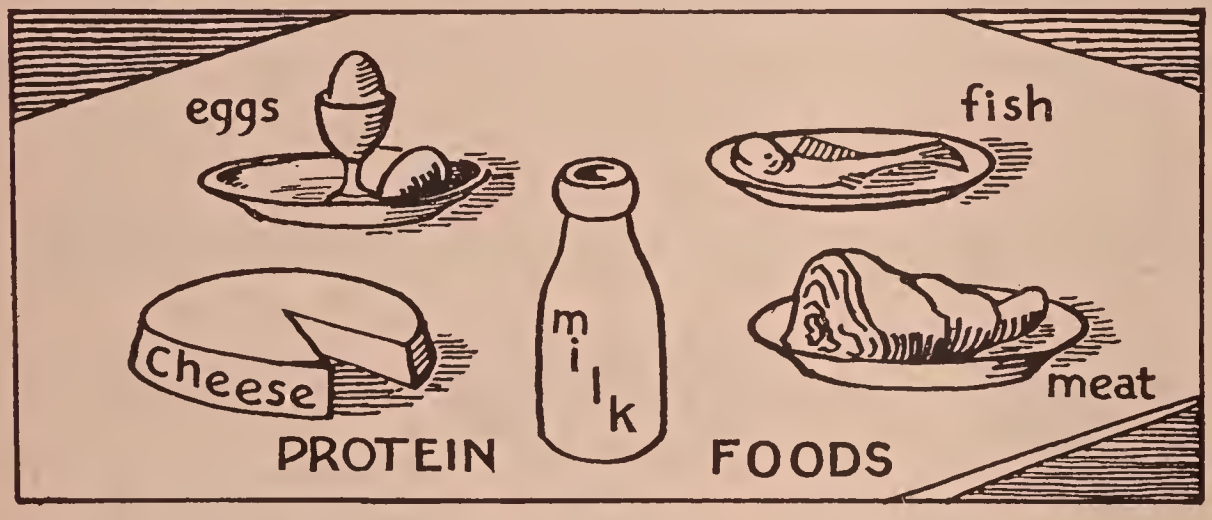
When our bodies work, they use up heat. Food is fuel to keep up this heat.

A chauffeur who wants fuel for his automobile drives to a garage for gasoline. When our bodies need more fuel, we must go to the earth for fuel foods.

The fuel foods which we obtain from the earth are starch, sugar, and fat. Potatoes, bread, and cereals contain starch. Apples, honey, and grapes contain sugar. Meat, butter, and cream contain fat. When we eat these fuel foods, they supply the heat which our bodies need for their work.

There are other reasons why we need food.

Food helps to repair our bodies. It also helps them to grow.



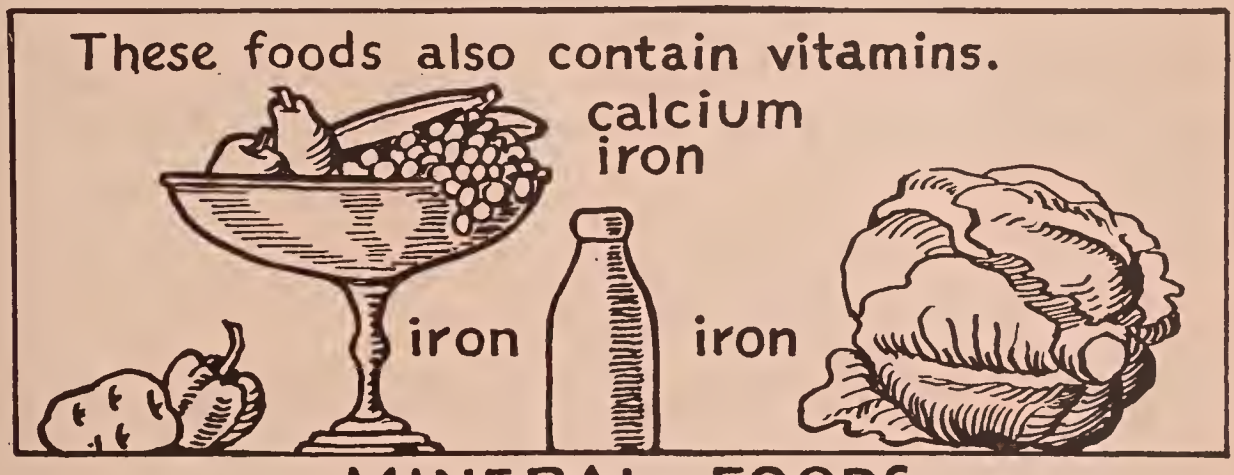
All through our bodies there are life cells which are so small that they cannot be seen by the naked eye. But when we look at a drop of blood or a piece of skin through a microscope, we can see these cells. While our bodies are working, these cells are being worn out.

When the parts in an automobile engine wear out, the chauffeur takes the car to a garage. The garage mechanic mends the old parts or puts in new parts. When our bodies need repair, we must go to the earth for repair foods which have life cells in them. The life cells which are in the repair foods help to mend the old cells in our bodies or furnish us

with new cells for our skin and blood, our meat and flesh and bone. The part of our food which contains these life cells is called *protein*.

Lean meat, milk, fish, cheese, eggs, nuts, and vegetables are repair foods. They contain protein. Some of these foods also contain sugar, starch, or fat.

Many foods which we eat contain minerals, such as calcium, lime, iron, and salt. The body needs these minerals



MINERAL FOODS

as part of its food. Minerals help in the growth and repair of the body.

Some foods which we eat contain tiny amounts of certain substances known as *vitamins*. These vitamins are found in many foods, but especially in green, leafy vegetables, fresh fruits, milk, and in whole-grain cereals. Scientists tell us that it is important for us to eat foods which contain vitamins.

Water

Every food that we eat contains some water. But this is not enough water for our bodies. We need to drink water

freely both with our meals and between meals. Plenty of water will help to keep us well. Without water, our bodies cannot get the whole value of the rest of our food.

What We Should Eat

Until a short time ago most people believed that by eating a great deal of food, they would be sure to satisfy their bodies. But during the last few years people have learned that *what* we eat is more important than *how much* we eat. We must know how to choose foods so that our bodies get fuels for their work and protein for repairing old cells and building new ones.

For boys and girls who are still growing, eating the right foods is especially important.

Boys and girls should eat plenty of fat, especially the fat in milk, butter, cream, fish, and eggs.

Boys and girls should have plenty of sugar and starch in their meals. They can get starch by eating bread, cereals, potatoes, beans, peas, and some other green vegetables. They can get sugar from honey, fruits, and milk. They should not eat much table sugar or candy.

Fuel foods should make up the larger part of a day's meals. But a good portion of each meal should be the repair foods which furnish new life cells to help the boy and girl in their growing.

For proteins the boy and girl should be sure to drink much milk every day. Cheese, fish, and meat will add to their supply of proteins.

Boys and girls must have foods which contain minerals. Milk will supply them with calcium and lime, two minerals needed for their bones and teeth. Fruits and some vegetables, such as tomatoes, will add iron, which their blood needs.

Every boy and girl should eat some green leafy vegetables, such as cabbage, celery, spinach, and lettuce. These contain minerals and life cells which our bodies need. The water in which any vegetable has been cooked should not be thrown away. It is rich in minerals and should be served as part of the meal. Children should also eat these foods because they contain vitamins.

Foods of Other Lands

We have read about the foods which people in this country eat. Let us see what foods people in other lands have for their meals.

Out on the deserts in Africa and in Arabia, where few animals live and few plants grow, people drink camel's milk. Here and there on the deserts there are green spots called *oases*. In an oasis water flows and the date palm grows. The desert people eat dates from their palm trees.

In the moist tropical jungles there are many wild plants bearing fruits and nuts which are good to eat. The jungle people eat bananas, coconuts, and many tropical vegetables. They also eat fish which they catch in their rivers.

In the cold Arctic lands, the Eskimos hunt the walrus, the seal, the caribou, and the white bear for meat. They catch

fish in the icy waters. The Eskimos have few plant foods to give them sugar and starch for fuel, but they make up for this lack by eating great quantities of fat.

In the tropical jungles and in the cold Arctic countries, people get their food from wild plants and wild animals, but we get most of our food from animals and plants which are raised for us on farms.

Long ago men had to be contented with such foods as could be found or cultivated near their own homes, but nowadays foods can be shipped great distances to many parts of the world.

The United States ships wheat to many countries of Europe. We buy coffee from South America and tea from Japan. Great Britain buys much of the food used by her people from other countries, even from far-away Australia.

Since man has invented methods of preserving foods, it is possible for many countries of the world to exchange food products with other countries. In this way a great world trade in foodstuffs has been built up.

Questions to Answer

1. In this chapter you learned why your body needs so many different kinds of food. Can you name some of them?
2. Can you name some of the foods that we buy from other countries? Why do we have to buy them?
3. Can you name some of the foods that we sell to other countries? Why do we sell them?

Chapter 10

HOW WE GET OUR MEAT

When we want to eat meat, we do not have to go out to hunt wild animals as the cave men did. Where we live, man no longer lives by hunting. In the woods near our homes, rabbits, hares, and squirrels may live, but there are not enough of them to feed us all.

Getting Meat in Wilderness Days

Before the white men came to this country, the Indians who lived here hunted bear and deer and ate their flesh. Out on the plains west of the Mississippi River the Indians hunted buffalo.

When the white men first came to America to live, they also hunted wild animals for meat. But before long they brought over from Europe sheep, cattle, and hogs, such as farmers in Europe had been raising for a long time.

Now, when the white men had these animals, they were able to get beef from their cattle; mutton from their sheep; ham, bacon, and pork from their hogs.

For a long time the white people kept on spreading across the country, turning the wilderness into farms and cities. As they cleared away the forests, many of the wild animals disappeared. The farmers, therefore, were glad to have the meat from their cows, sheep, and hogs. They ate some of

this meat themselves. The rest they sold to the people in the cities.

Meat for the Cities Today

Within the last fifty years the cities have grown large, and the small farms in certain sections of our country are no longer able to supply all the people in the cities with meat. So today we get most of our meat from a few parts of the country, where millions of cattle, sheep, and hogs can be raised and fed more easily than anywhere else.

We get much of our beef, lamb, and mutton from the pasture lands in the western and southwestern part of the country. For ages, buffalo lived on these plains. But when the Indian hunters and the white men killed off the buffalo, herdsmen began to raise sheep and cattle. They raised their herds on large tracts of land called *ranches*.

Meat from the Ranch

The rancher, who owns the ranch, may have many thousands of cattle or sheep. A cattle rancher has cowboys to help him with his herd. The cowboys water the cattle. They take care of injured or diseased animals. They 'break' the horses for riding, and conduct the 'round-up.'

Each ranch owner must know his own cattle. There are several ways of marking cattle so that no mistake will be made when the herd is sold. The most common method of marking them is called *branding*. Each owner has his own initials or symbols, which are burned into the hide of the animal. These initials are registered in the official books of

the state, so that no other owner can adopt the same mark or claim cattle branded with it.

When the time comes to sell the cattle, the cowboys go out for the round-up of the animals, which have been running over the *great plains*. On these plains the soil is not fertile, and there is not enough rainfall to raise crops; but even with little rainfall, wild grass grows readily, and it is on this wild grass that the cattle have been grazing. Surrounding the cattle from all sides, the cowboys pick out the ones which are marked with the brand of their ranch and drive them all into a great yard, or *corral*.

From this corral the cattle are driven to the railroad station. Here they are loaded on trains and sent to one of the meat-packing cities, where meat is packed and made ready for shipment to all parts of the country. Chicago and Kansas City are two important meat-packing cities.

On the same train with the cattle there may be many cars of sheep sent from the sheep ranches which are near the cattle ranches.

When the sheep and cattle reach the packing cities, they are unloaded in large stockyards.

Meat from the Corn Belt

In the stockyards there are also thousands of hogs which have come from the farming plains in the states which lie near the Great Lakes. The Great Lakes lie between the United States and Canada. This part of our country is called the *corn belt*, because on these plains where rain is plentiful,

the soil rich, and the summer long, corn grows well. As hogs get fat on corn, the farmers in the corn belt raise many hogs. As cattle also like corn, many young cattle from the western ranches are shipped to the corn belt for fattening.

In the summer and fall the farmers in the corn belt feed their hogs and cattle fresh corn from the fields. Green corn is stored in corncribs for hogs; fodder corn is grown for winter food for cattle. Harvesting and storing this winter food is one of the most important tasks of the autumn season. A corn-harvesting machine goes through the field of corn, cutting and binding the stalks into bundles. These are chopped up and stored in a building called a *silo*.

A man feeds a bundle of cornstalks and leaves into a rotating set of knives which cut it into pieces. These pieces are either blown through a chute into the silo or are carried into it on a belt.

The silo is usually built as part of the barn. A silo is a building shaped like a cylinder. I am sure you have noticed silos when you have been driving through the country. If you have driven through farm country in the early autumn, you may have seen the farmers busy filling their silos with winter food for their cattle.

Cattle which have been shipped to the corn belt for fattening are sent, when ready for market, to the stockyards. From the stockyards the cattle, the sheep, and the hogs go to the slaughterhouses where they are killed and prepared for packing. Almost every part of these animals is put to some use.

Preparing Meat for Market

Some of the meat is hung in large cold-storage plants ready to be put on trains and sent to the cities to be sold in meat markets. Some is used for making sausage. Some is salted or smoked so that it will keep for a long time. Some is preserved and put into cans which are sealed tightly. The hides of the animals are sold for leather; the horns of the cattle and sheep are used for button-making; hoofs are used in making glue.

The meat is put into cold-storage rooms. Here cold air is run through pipes, and the cold pipes make the rooms like ice boxes. Meat stored in these cold rooms will remain fresh for months.

The refrigerator trains which carry fresh meat to the cities are cooled by ice or pipes in the same way as the cold storage rooms are cooled.

Every morning the refrigerator trains which come into the railroad stations near our homes bring fresh meat from packing houses. The butcher's wagon gets the meat and carries it to the store where we buy it by the pound as we need it. At the grocer's we can buy canned meat.

The meat which we buy may have been raised fifteen hundred miles from our homes. Ranchers, cowboys, sheep herders, farmers, trainmen, and hundreds of workers in the stockyards and in the packing houses have helped in bringing that meat to us. Some meat makes a longer journey than fifteen hundred miles before it gets to market.

Exporting and Importing Meats

In England there are forty million people. Many of these people live in cities and work in factories. The farms are few and small. As there is little room to raise great herds of sheep and cattle, the English people buy, or import, much of their meat from other countries. When one country buys things from another country, we say that it is *importing*. When a country sells things to another country, we say that it is *exporting*.

England imports meat from the United States, from South America, and from Australia. Both in South America and in Australia large herds of sheep and cattle are raised on plains of wild grass.

As these countries have not many people to feed, they are able to sell, or export, much meat. The meat exported from South America to England travels five thousand miles to reach its market. The meat exported from Australia to England is brought in ships over a distance of twelve thousand miles.

Questions to Answer

1. What is the difference between the way the cave man got his food and the way we get ours?
2. Where does the meat which your mother buys at the market come from?
3. Can you describe life on a cattle ranch?
4. What is a round-up?
5. How does the owner of a ranch know his own cattle?
6. What does the cowboy do on the ranch?

7. What kind of food does the ranch owner give his cattle? Where does he get the food?

8. What did you learn about England, Australia, and South America?

Things to Do

1. Construct a ranch on the sand table in your classroom.
2. Draw a picture of a ranch.
3. Draw a picture of a round-up.
4. Draw a picture of a mark that might be used to mark all the cattle in one herd.
5. Draw a picture of a stockyard.
6. Copy the words and phrases in the list below. Write the meaning of each one on the line opposite the words.

branding _____
silo _____
stockyard _____
diseased cattle _____
corral _____
refrigerator _____

7. Find the Great Lakes on your map of North America.
8. Find, on the map of the United States, the states in which cattle-raising is carried on.
9. Find, on the map of the world and on the globe, Australia, South America, England.

Chapter 11

MILK, CREAM, BUTTER, AND CHEESE

Milk is a good food. It quenches our thirst and satisfies our hunger. Milk contains sugar and fat, which are fuels for our bodies. Milk is rich in proteins, which help mend our body cells. Milk also helps us grow. For little babies, milk is a most necessary food.

In the last story we read about the cattle ranches, where cows are raised for meat. But how about the cows which give us our daily milk? Do they live out on the cattle ranches?

Many cows are raised on large dairy farms which are scattered throughout the middle western and middle Atlantic states and New England.

Cows Brought to America

The best milk cows are known as Holsteins, Ayrshires, Jerseys, and Guernseys. The first Holsteins were brought to this country from Holland; the Ayrshires came from Scotland; the Jerseys came from the island of Jersey, which is near France. The first Guernsey cattle came here from the island of Guernsey, which is near the island of Jersey.

Can you imagine the old sea captains and sailors bringing these cows across the Atlantic? For the few weeks on the

ocean the captain and his mates had good milk to drink. Then when they reached America, they sold the cows to American farmers, who turned them loose on their pasture lands.

Today the descendants of those seafaring cows are giving us milk.

Visiting a Dairy Farm

If we arrive at a dairy farm early on a summer morning, we see the farmer letting the cows out of the large barn where they have been milked. The cattle follow their leader up the road, across the brook to the pasture, where fresh green grass is growing. There they eat the grass for an hour or so. This grass goes down into one of their four stomachs. Then as the day grows warmer, the cattle lie down in the shade, bring up the grass which they have swallowed, and chew this cud. After an hour or more of chewing, they swallow the cud, and it goes into their other stomachs. In these three stomachs part of the grass which they have eaten is turned into good rich milk.

In the evening the farmer drives his cattle back into the barn, where he milks them. In the early morning they are milked again. Often cows have so much milk that the farmer has to milk them three or four times a day. On all the large dairy farms the milking is no longer done by hand, but by milking machines.

Until a few years ago many farmers did not keep their barns as clean as they do now. The dairy farmer of today knows how important it is for him to keep his cows and

his stables clean. In many large dairies where milk commands a high price, all employees are dressed in clean white clothing while working about the cows. Every morning the stalls are thoroughly washed by a hose playing water on the cement floors. Before a cow is milked, she is carefully washed.

Milking is done by machines which are highly sanitary. The milking machines are covered to keep the milk free from dust and dirt. You can see why machine-milking is cleaner than milking by hand into open pails.

Milking machines also save labor, for most of these machines milk two cows at once. One man caring for two machines can milk four cows in less time than he can milk one by hand.

Milk readily absorbs odors. Good dairy farmers have their milk houses apart from the other farm buildings. The milk house has a cooling tank, so that the temperature may be cool enough to keep the milk sweet. Most milk houses have cement floors and are carefully screened to prevent flies from coming into them.

When the weather permits, the milk utensils are placed outside, so that the sun's rays and the fresh air may help to purify them.

What does the cow eat in the fall and winter when there is no grass in the pasture? In these seasons the farmer keeps his cattle in the barn and feeds them on hay, which is dry grass. He raises this grass in the summer, gathers it, and stores it in the hay barn. He also feeds his cattle the stalks

of corn which he has stored in the tall silo beside his cow barn.

Bringing Milk to the City

Each day the farmer puts his milk into cans. Instead of carrying his few cans of milk to the city, which may be a day's journey from his farm, the farmer sells his milk to a milk company.

Each day the milk company sends trucks to gather the cans of milk from many farms. Then the company sends the milk to the city by train or truck. In the city some of the milk is sold to grocers in cans. The milk is also sold in quart and pint bottles, marked with labels.

Clean milk bottles are necessary to keep milk in a clean condition. They are washed in large washing machines, brushed inside and out with brushes, and rinsed with clean, sterile water.

The milk bottles are carried on trucks to the machines which fill them with milk. Some of these machines fill as many as eight dozen bottles a minute, filling and capping them without the help of human hands.

Bottles of milk that are shipped on trains are packed in boxes, surrounded by chipped ice, and placed in refrigerator cars.

Sometimes milk is shipped in bulk instead of in small quantities. It is cooled and placed in large tanks with double walls very much like the thermos bottle in which your mother takes hot coffee or iced tea when you go to the woods on a picnic.

Keeping Milk Pure

On some of the bottle caps we can read the word *pasteurized*. This means that the milk has been heated to a temperature of 150 degrees and has been kept at this temperature for twenty minutes, then rapidly cooled. This method of making milk pure was discovered by a Frenchman whose name was Louis Pasteur. The word *pasteurized* comes from his name.

The company pasteurizes some of its milk because the heat kills little plants called *bacteria*, which live in milk. These bacteria are so small that you cannot see them without a microscope. But if they are not killed the milk spoils more quickly.

Foods Made from Milk

Did you ever read the poem which Robert Louis Stevenson wrote about a cow?

The friendly cow all red and white
I love with all my heart;
She gives us milk with all her might
To eat with apple tart.

The cow also provides us with cream, butter, and cheese. We get the cream, butter, and cheese from the cow's milk. If milk is allowed to stand for several hours, cream will rise to the top, or the cream can be separated from the milk more quickly by machine separators. That part of the milk which is left is called *skim milk*. Many people like cream

with fruit or cereals. Almost everybody likes ice cream, which is sweetened cream made stiff by freezing.

Butter is made from the fatty part of the cream. Butter can be made in a small hand churn by pounding the cream with a wooden dasher. This pounding separates the butter fat from the rest of the cream. The part of the cream which is left is called *buttermilk*. Today most of the butter in our country is made in large machine churns which make hundreds of pounds in one churning. Some of this butter is sent to the cities in tubs. Some is weighed and wrapped in small packages. In one of these two ways it reaches the city grocer.

Cheese is made from the protein which is in milk. This milky protein is called *casein*. Some farmers who do not sell their milk to milk factories, sell it to cheese factories. Here the milk is heated in vats; and as it sours, it divides into two parts: curds, which contain the casein, and whey. The curd is made into cheese. The farmers carry the whey back to their farms and feed it to their chickens and hogs.

Thus you see that the cow gives man not only meat but also milk, cream, butter, and cheese.

Questions to Answer

1. Where are the great dairy farms of the United States?
2. Can you name the different kinds of cows that are bred in America?
3. Can you name the native lands of these different cows?
4. How is milk pasteurized? Why do dairymen pasteurize the milk?
5. What other foods are made from milk and cream?

Things to Do

1. Find, on your map of the United States, the states where the great dairy farms are located.

2. Imagine you are spending a day on a dairy farm; write a story about the day.

3. Tell how the dairymen prepare milk for the market.

Chapter 12

POULTRY AND EGGS

Every morning at breakfast time, in many homes throughout our land, people eat eggs.

To supply our tables with eggs, thousands of poultrymen and farmers raise chickens on their farms.

The chicken is a bird which has been tamed by man.

In our country today, there are many wild birds, such as the robin, the owl, the hawk, and the eagle. Some of these birds live with us all the year round. Other birds, like the wild goose, the wild duck, and the wild turkey, fly southward in the winter to find themselves new homes in warmer lands. The wild turkey has almost disappeared from our land.

All the birds of the air were originally wild, building their own nests, fighting their own battles, finding their own food, and flying where they wished. But long ago, after men tamed cattle and sheep, they tamed some of the birds as well. They tamed the goose, the duck, the turkey, and the chicken.

These birds which men have tamed and which they raise for food are called *poultry*. A farm where they are raised is called a poultry farm.

The story of each of the poultry birds is interesting.

The Story of the Chicken

Far away in tropical India there is a bird called the *jungle bird*, which is really a wild chicken. This jungle bird lays about four eggs a year. Thousands of years ago some people in Asia succeeded in taming one variety of wild chicken, which may have been much like the jungle bird.

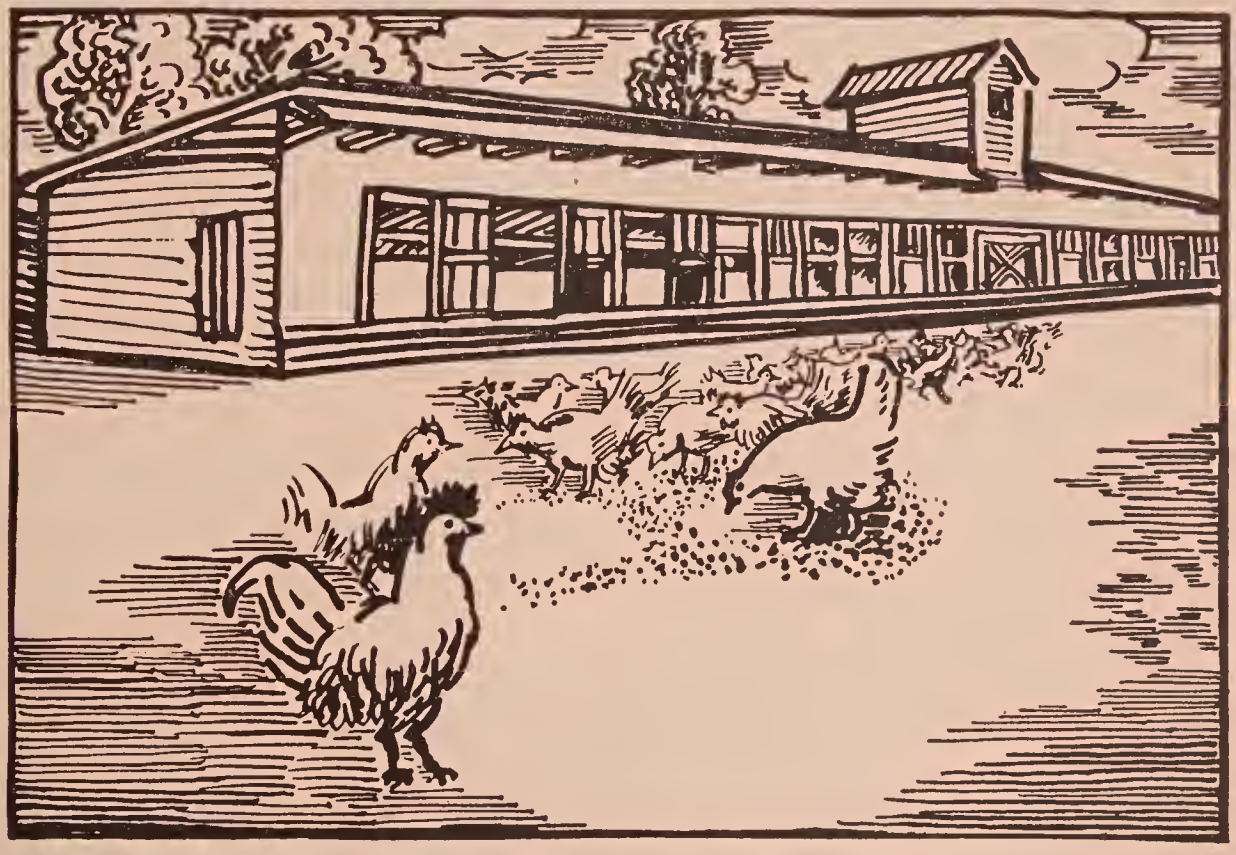
While the jungle bird, itself, remained wild, farmers in Persia, India, and China raised on their farms the chickens that had been tamed. The chickens crowed in the barnyards; they roosted in trees; they ate such scraps of food as the farmers threw to them. The barnyard hens laid more eggs than the wild jungle birds from which they came. Later the farmers in Europe also learned how to raise these chickens.

When farmers came from Europe to this country, they brought chickens with them and raised them here. The farmers and their families ate some of the eggs which the hens laid. They sold some eggs to people in the towns. They allowed the mother hens to sit upon the rest of the eggs for twenty-one days. It takes a chick that long to be hatched from an egg.

Today the small farm can no longer raise enough chickens to supply the people of our great cities with fowl and eggs. There are now large farms where as many as fifty thousand chickens can be raised at one time.

Visiting a Chicken Farm

First we visit the incubator house, where heaters are used to hatch the baby chicks. The boys from the farm are arriving with baskets full of eggs which they have gathered that day. We follow them into the house. We see them put



The Chicken Farm

the eggs into trays. Then they put the trays into incubators which hold thousands of eggs.

The heaters in the incubators will keep the eggs warm for twenty-one days. At the end of that time when the boys remove the trays, they will find that the chicks have broken through the egg shells.

The chicks are then put into brooders. These brooders

are small houses where little stoves keep the chicks warm. They are carefully fed and grow rapidly.

On the farms there are many laying houses, each holding hundreds of hens. Here the hens lay their eggs. Today there are many hens which lay more than two hundred eggs a year. Some hens even lay three hundred eggs each in one year.

So we see that the egg which we eat for breakfast has an interesting story. The story begins somewhere in Asia with a relative of the wild jungle bird of India. Then the story comes into Europe and carries us across the ocean to America.

In America there are also large duck farms, large goose farms, and large turkey farms.

These poultry farms of America add to our supply of food. But there is a way in which even wild birds help to feed us.

How Wild Birds Help Us

Many of the wild birds feed on insects. Many insects feed on growing grains, vegetables, fruit trees, and other plants which give us food. The birds which eat these insects save a large part of the farmers' crops.

Many birds feed on seeds. In the past, when farmers saw birds eating grains, their first thought was to shoot them. But today we know that birds which eat seed really help the farmers. During the spring they eat many seeds of useless weeds and in this way they make it easier for the farmer to raise his crops.

Questions to Answer

1. What is an incubator? What is a brooder?
2. In what ways are birds a help to the farmer?
3. In what parts of the world did men first develop chicken farms?
4. Why is chicken farming an important occupation?
5. Can you figure how many dollars a farmer might get from selling the eggs that one good hen lays in one year?
6. Does the farmer have to buy food for his hens?

Chapter 13

FOOD FROM THE SEA

Long ago in the days when men lived by hunting, they learned that some fish are as good to eat as some land animals. So they caught fish as best they could and ate them. Once they knew how to make them, they used small nets with which they caught their fish. When they learned how to make boats, they went out in boats to fish in the rivers and in the lakes. Later, when they learned how to build ocean boats, they sailed on the ocean to catch ocean fish.

Now all over the world people eat fish. If they cannot get fresh fish, they buy dried, smoked, or canned fish.

The Fish We Eat

There are many different kinds of fish, but the ones which people in this country eat most often are cod, haddock, mackerel, halibut, herring, whitefish, and salmon. Cod, haddock, mackerel, halibut, and herring live in the ocean. Whitefish are found in the Great Lakes. Salmon are hatched in rivers, but they live much of their lives in the ocean. When salmon are ready to lay their eggs, they return to the rivers in which they were hatched. They swim up the rivers, leaping the falls to reach the shallow waters where they lay

their eggs. In the western part of the United States there are a few great rivers flowing into the Pacific Ocean. Each autumn salmon come up these rivers from the ocean, and here fishermen catch them.

Along the bottom of the oceans there are valleys, mountains, and plains, just as on dry land. Fish are usually found in greatest numbers over the shoals, or shallow places, where the ocean bottom lies only a little way, perhaps fifty to six hundred feet, below the surface of the waves. Here sea plants grow; small fish feed on the sea plants; and large fish feed on the smaller fish. These shallow places where fish are abundant are called *fishing banks*.

Catching the Fish

Few of us ever think, when we eat fish, that there are tens of thousands of fishermen all over the world who spend their lives in getting us this food.

Let us see a few of the ways in which fishermen catch fish for us.

Boys who live in the country near brooks or rivers often fish with poles, lines, and hooks, on which they put small fish or worms for bait. In some lands fishermen catch fish by spearing them or by harpooning them with spears tied to ropes. But fish poles, spears, and harpoons cannot catch enough fish for the hundreds of millions of people who live in the world. Most fish are caught by other means.

To catch many fish at one time, men use nets made of strong cord knotted or woven together in such a way as to

leave open meshes. These nets are made in different sizes. There are nets so small that men can manage them by hand. There are nets so large and heavy that they have to be lowered and raised by steam power.

When steamboats carrying large nets reach the fishing banks, each boat lowers its net into the water. Weighted wooden beams help the net to sink; then, as the ship moves through the water, the net slowly closes on the fish which are swimming in its path. Small fish escape through the meshes, but the big fish are prisoners; and when the net is raised, they are emptied into tanks in the hold of the boat.

Another way to catch fish is by the use of long lines to which many smaller lines with baited hooks are attached. This kind of fishing is usually done from sailships.

Three times a day fishermen leave these sailships in small dories. In each dory there are two kegs containing the line. One man rows the dory; the other slowly lets out the lines, which may be a mile long. While he is still lowering the line, he can feel the weight of the fish which are being caught on the baited hooks. The kegs which have been thrown overboard serve as buoys, supporting the long line which grows heavier and heavier with its increasing load of fish.

After a time the rower guides the dory back along the line. The fish are removed. The hooks on the short lines are freshly baited and thrown back into the water. Then the men row back to their ships to unload.

Going out in a dory is dangerous business. The waves are often high and rough. If a fog rises, the men have to

listen for the ship's fog horn to help them find their way back. If the wind is against them, so that they cannot hear the fog horn, they may lose their ships. Many a dory has drifted on the ocean for days before being picked up.

In the winter, even when all goes well, the men must face bitter cold. The fishing boats return to port covered with ice.

Bringing Fish to Market

To catch fish is not enough. Fish spoil easily, and if we are to have them for food, they must be kept from spoiling. Some fish are packed in ice in the hold of the ship. When the ship reaches port, they are repacked and sent to the fish stores near our homes where we can buy them fresh. Some fish are salted, because salt helps to keep them from spoiling. Codfish are laid out to dry on land. A good many of the salmon which are caught in the rivers near the western coast are dried and smoked. Smoked fish, as well as salted fish, will keep a long time. A great number of the salmon are taken to factories where machinery cuts them and packs them in air-tight cans.

Most of our ships which catch fish in the Atlantic Ocean sail from a few coast cities in the part of our country which is called New England. Each of these cities sends out fleets of fishing vessels. These vessels do much of their fishing on the Grand Banks off the coast of Newfoundland. On the Grand Banks there are fleets of fishing boats from France which stay for six months and more. On the other hand, some of our fishing boats cross the ocean to catch fish in

waters off the coast of Iceland, Greenland, and Ireland. The largest of these fleets sails from the city of Boston.

Fishing is carried on in the Great Lakes in much the same manner as on the ocean. Nets and baited hooks bring in quantities of lake trout, whitefish, lake herring, and blue pike.

The countries which face the oceans claim the water for three miles from their coast lines as their own fishing grounds. But outside of this three-mile limit, the oceans are free to the fishermen of the world.

Oysters

Oysters, which are shellfish, grow in shallow water, known as *oyster banks*, off the coast of the United States in many places. The states of Maryland and Virginia lead all other states in oyster fishing. The flesh of the oyster is enjoyed both fresh and canned, and the shells are ground up and fed to chickens to furnish them with certain minerals which they need.

Protecting Our Supply of Fish

Of late years, some men in our country have been giving much thought to fish. There are states which have fish hatcheries, where fish are kept in pools and fed. Fish eggs and baby fish from the hatcheries are put into the state rivers and lakes to keep them well stocked.

Fish in the lakes and streams of our country are protected by laws called *game laws*. These laws keep people from fish-

ing at times when the fish are laying eggs or raising their young. They also make it unlawful to catch fish which are too small.

Some nations have joined together to study ocean fishing, so that the ocean fish will not be destroyed. They are planning that their fishermen shall not fish during the time when mother fish are laying eggs from which the oceans will renew their treasure.

So we see that today the oceans which help to carry man from land to land are binding men in other ways as well. Because the oceans' harvest of fish helps to feed them, the nations are joining hands as brothers to protect the food which they must share.

Things to Do

1. Make a collection of pictures showing all the kinds of fish you read about in this chapter.
2. Make some drawings of the many kinds of fish.
3. Make a set of drawings showing the different ways men catch fish.
4. On an outline map of North America color the sections where fishing is carried on. If you do not remember, read the chapter again.
5. Arrange a spelling contest in your class. Use the list of words below.

mackerel	codfish	harpoon	fisherman
halibut	valley	dory	fisheries
herring	coast	pole	factories
haddock	mountain	shoals	vessels
salmon	spear	buoy	bait

Chapter 14

WHEAT AND OTHER GRAINS

A loaf of bread is on the table. We shall eat bread with our lunch. We had bread toasted for breakfast. For dinner we may eat rolls, which are only another form of bread. Even our cakes and cookies and biscuits and the crusts of our pies are really bread.

Bread: a Plant Food

To make bread, white flour is mixed with water. Sugar, salt, yeast, and lard are added. This mixture is then kneaded by pounding and squeezing and then by more rolling and squeezing. Kneading the flour, water, salt, sugar, yeast, and lard together in this way gives us dough.

The dough is then shaped into loaves and put into a warm place to rise. When it has risen, it is put into the oven and baked. After the loaves have cooled, the bread is sliced and placed on the table.

This bread does not look much like a plant food, but bread is plant food. The flour used in making bread comes from the seed of a plant called wheat. Wheat is a grain. There are other plants, like rye, oats, barley, rice, and buckwheat, which are also grains. All these plants bear clusters of small seeds, or grains, each of which is packed in a hard little shell.

Corn is also a grain, but the seeds of the corn plant are clustered on a long stick or cob.

Bread can be made from the grains of rye, barley, and corn, as well as from grains of wheat. Our oatmeal is ground-up

oats. Our buckwheat cakes are made from flour ground from the grains of the buckwheat plant.

Wheat and some of the other grains are among the oldest plant foods in the world. Long ago men learned that some wild grains are good to eat.

Many birds like to eat the kernels of the wild wheat seeds.

It may be that early man learned to eat wheat by watching the birds.

In the beginning people ate the seeds of the wheat just as they found them on the plants. Next they learned to make a coarse flour by pounding the grains on a stone. By mixing this flour with water, they made a dough, which they baked on hot stones.

Wheat-Farming in Ancient Times

We have read that when people learned to plant seed, they became farmers. In the Valley of the Nile, the farmers of Egypt raised wheat six thousand years ago.

When we go to the art museums in the large cities, we can see pictures of farming in old Egypt. These pictures were cut into stone by Egyptian artists, and they show us how the farmers of long ago raised wheat and prepared flour.

In breaking up the earth to make it ready for planting, the farmers of Egypt used wooden plows. They had oxen draw the plows across the fields. They sowed the seed by hand; and when the wheat grew to its full height and the long stalks bore their precious grains, they cut the stalks with a sickle. The farmers bound the stalks by hand and carried them to barns, where they were laid on the floor. Here donkeys, by walking on the wheat, stamped the seeds loose from the stalks; at the same time they loosened the shells from the grains. This is called *threshing* the wheat.

The next step was separating the shells from the grain.

This is called *winnowing*. The Egyptians winnowed their wheat by throwing the grain into the air with a pair of flat wooden tools. As the grain fell, a man fanned the air, so that the light shells, or husks, would blow away.

How did the Egyptians make flour from this grain? They ground it between two round milling stones, placed one above the other. The lower stone was partly hollowed out. The upper stone had a hole in it. The grain pouring through this hole fell into the hollow space between the two stones. The flour maker turned the upper stone on the lower until the grains were crushed into a coarse flour.

In time the farmers in other lands learned easier ways of grinding the wheat. In some places they had donkeys or oxen walk round and round in a circle to turn the upper millstone against the lower. Some farmers built themselves mills in which the millstones were turned by the power of falling water. Near the water mills, they built dams of stone or wood to hold back the water; at one point close to the mill they allowed the water to flow from the dam over buckets on to the blades of a mill wheel. The push and the weight of the water made the mill wheel go round. And as the wheel went round, it turned the upper millstone which was inside the mill. Here the farmers from the neighborhood could have their flour ground very quickly. Because of the great weight of the millstones, they could have their flour ground much finer.

When the people came from Europe to make their homes in America, they brought grains of wheat with them, but

their wheat did not grow well in the fields which they cleared near the Atlantic coast. Instead of wheat they ate corn.

A New Grain Found in America

Corn is an American grain which the Indians raised. The newcomers learned from the Indians how to plant corn and how to make good things to eat from the corn harvest. They ate johnnycake, which they made from cornmeal, a coarse corn flour. They ate succotash, a dish of corn and beans cooked together. They dried the kernels of the corn in the sun until they became almost as hard as stone. Then they kept these hard seeds into the winter, when they used them to make corn mush. They made corn mush by soaking the kernels overnight in water, then serving the softened seeds with milk.

As the white people went west in this country, they found one part of the land where for more than one thousand miles there were good farming plains. Plenty of rain would help corn and wheat to grow well there. This *corn and wheat belt*, as it is called, lies west of the Mississippi River and reaches almost to the Rocky Mountains.

The farmers working with the old farm tools found that they could not do all the work themselves. They needed new tools which would do the farm work more quickly than the old tools, which had hardly changed since the days of the Egyptian farmers.

Machinery Brings New Ways of Farming

New farming tools were invented by American inventors. About the year 1831 Cyrus H. McCormick, an American farmer, invented a *reaper*, a machine which could cut several acres of wheat in less time than a man with a hand tool could cut one. This reaper and other inventions helped the farmers on the great farming plains.

Today on a large wheat field in the West the ground is plowed up by large steel *gang plows*, as they are called, drawn by teams of sixteen horses. On some farms the plows are drawn by tractors, run by gasoline or kerosene engines.

After the blades of the plow have cut wide furrows in the soil, other machines, called *harrows*, are drawn across the fields to cut the furrows and smooth them.

Then a machine with many steel drills is drawn across the field. These drills sow the seeds of wheat into the earth.

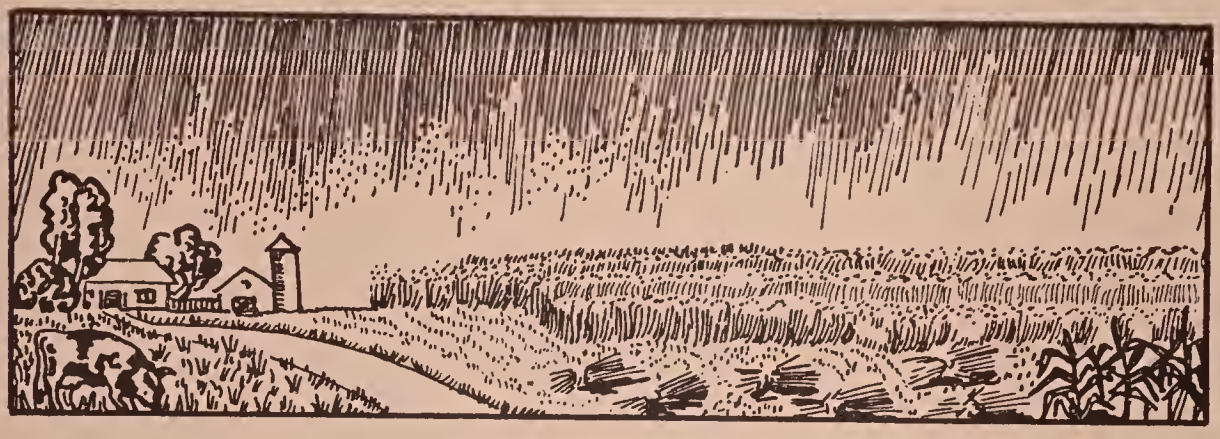
In a few days pale green shoots, which look like grass, appear above the earth. The roots below the earth draw food and water from the soil. The leaves, helped by the sun, change the earth food into life cells for the growing plant. The wheat grows higher and higher. In a few months the tall stalks turn from green to yellow as they ripen. They bear heads of grain.

The wheat is now gathered by a harvesting machine. The harvesting machine of today cuts the wheat, collects the stalks into bundles, ties the bundles, and drops them in rows.

The bundles are then thrown into a threshing machine

which is run by a steam engine. Inside the thresher the grains are separated from the dried stalks, or straw. The husks are loosened and blown away. As the grains of wheat flow from the thresher, they are packed in sacks.

Even the grinding of the grain into flour is done by new tools. Railroads and steamships carry millions of bushels



A Farming Plain

of wheat from the wheat farms to the large cities where they are stored in tall buildings, called *grain elevators*.

From the grain elevators the grain goes to the flour mills. Flour mills are still built near waterfalls, but the millstones are no longer turned directly by water wheels. They are turned by electric power engines which get their power from the falling water. One such electrically driven engine can help grind more flour than many of the old water wheels.

Even the baking of bread from flour is now done by new tools. Few women bake bread in their own homes. They buy bread from large bakeries, where most of the work is done by machinery.

New tools are also used in raising corn. Some green corn is sold to the cities, and then we eat the kernels from the

cob after boiling it or roasting it. Some of the green corn is sent to the canneries for canning. Much of the field corn raised in the corn belt is ground into corn flour, or corn meal, as it is generally called. The farmer also feeds corn to his cattle and hogs. In the winter he feeds his hogs dried ears

Indians Gathering Wild Rice

of corn from the corn crib. He feeds his cows cornstalks from the silo which stands beside his barn.

In China the people hardly ever eat wheat or corn. They eat rice, which is another one of the grains. They raise this rice in flooded fields. Rice takes the place of bread for the Chinese. Rice is also grown in the United States. Not so many years ago American Indians in some parts of this country gathered wild rice to add to their food supply. The picture shown here is from the American Museum of Natural History. It shows clearly how the Indians gathered the wild rice by threshing.

So, just as the deep sea yields fish to feed us, the earth bears grains to add to our daily meals. In our country today, with new tools to help them, farmers working where grain grows best, raise more than enough to feed all the people. Giant flour mills grind the grains. Ships and trains carry our wheat, corn, and other grains to feed the workers in our own land and in many other lands which cannot raise enough for themselves.

Questions to Answer

1. How many kinds of grain are used to make bread?
2. How did men in ancient times plant and harvest their grain?
3. What American invented the first reaping machine?
4. How is the farming of wheat carried on today?
5. How is wheat ground into flour?
6. How is bread made?

Things to Do

1. Make a set of pictures showing the ways men have used to grind grain into flour.
2. Make a visit to a bakery, if there is one in your town.
3. Write a few short paragraphs telling what you saw.
4. Learn to spell the following words, and be very sure you know what each one means:

bread	buckwheat	invention	kerosene
yeast	wheat	reaper	engine
flour	kernel	tractor	threshing
barley	plow	gasoline	grain elevator
dough	kneaded	clustered	harvesting

Chapter 15

A BASKET OF PLANT FOODS

Here is a basket of food, brought in by the grocer's boy. We stand by and watch while he unpacks vegetables, fruits, nuts, tea, coffee, cocoa, chocolate, sugar, pepper, all of which are plant foods.

The grocery store is near by; but the basket with its bright colors and its fragrance is like a bouquet of food, gathered for us from many climates and from many lands.

People who live in the country or in small towns often keep gardens in which they raise their own fruits and vegetables. But in cities the yards are often not large enough for gardens, and people are too busy doing other work to spend their time raising foods. City people are busy making the many things that country people need, while country people are busy raising foods for city people.

Indeed, people could not live in cities at all unless country people sold them fruits and vegetables and milk.

You may like to know how farmers find a market for all the foods they raise.

Fruits and Vegetables: Winter and Summer

Many years ago they took their own fruits and vegetables to market. Often they carried them in wagons through the

streets of near-by towns, selling them from door to door. But nowadays farmers living near the same shipping point often belong to an organization which takes care of selling their farm products for them.

Fruits and vegetables are assembled, packed, and stored by these organizations and sold by them to the stores from which your mothers may buy their food.

In the winter, vegetables will not grow in the open in the northern states. For this reason, in the winter people in the North get most of their fresh vegetables from farms in the southern states where it is warm enough for vegetables to grow in the open all the year round. It is also possible to raise green vegetables in hothouses, under cover, in the North. These are much more expensive than those grown in the summer time, and not all people can afford to buy them. Today many people eat canned vegetables as well as fresh vegetables.

So much for the vegetables which the grocer has sent us. See the luscious fruits which the basket holds. Here are apples and pears from the northern states, where the summers are short. Here are grapes, grapefruit, raisins, oranges, from sunny groves in California, Florida, and other southern states where the summers are long. Each fruit grows best in the climate which suits it. When grown in that climate, it tastes best.

With ships and trains to serve him, our grocer is able to sell us fruits from every corner of our land. He sells us fruits from other lands as well. In the basket there are dates from

date palms which grow on the oases in the distant deserts of Arabia and North Africa. There is a pineapple which may have come from the Hawaiian Islands, far out in the Pacific Ocean. There are bananas, which grow in the countries of Central America and in Colombia, which is a country in South America.

In these tropical lands which are washed by the waves of the Caribbean Sea bananas used to grow wild in jungles. Of late years men have been clearing away parts of the jungle to raise bananas on plantations. Bananas grow in large bunches, with each banana pointing upward. Before the fruit is fully ripe, the bunches are cut down. Fruit steamers bring the cargoes northward to us.

Nuts: Another Plant Food

Here are nuts; a bag of mixed nuts — walnuts, pecans, filberts, almonds, all of which grow in our country. But what is this? A coconut! Shake it! Hear the milk inside! This nut has come a long way. It may have grown on plantations in the Caribbean lands; or it may have grown on the South Sea Islands, far out in the Pacific Ocean.

Still we are not through with the riches of our basket.

Plants Which Flavor Our Drinks

We open a small can of tea. A short while ago the tea leaves were growing on bushes in China or on the island of Ceylon, south of India.

We open another package and we see coffee beans which

may have come from the island of Java, near Ceylon; or it may have come from Brazil, a country in South America where much of the world's coffee is grown.

Another package contains cocoa, and near it there is a bar of chocolate. Cocoa and chocolate do not look like plant foods, but they are both made from the oily beans of the cacao plant, which grows in the tropical lands of South America. These beans grow in pods. In cocoa the oil of the cacao beans is still present. In chocolate the oil has been removed. The cocoa and the chocolate were made from cacao beans in factories in our country.

Sugar from Cane or Beets

To sweeten our cup of cocoa or chocolate, the grocer has sent us a box of granulated sugar. The white crystals of the sugar may have been made from sugar cane. Sugar cane is a plant which grows in Cuba, an island south of Florida. It also grows on the Hawaiian Islands, on the Philippine Islands, in some of our Southern states, and in other warm lands. Cuba raises so much cane sugar that it is sometimes called 'the world's sugar bowl.'

In Cuba, for centuries, men have been clearing jungles for the planting of sugar. In the spring, stalks of cane are cut up and the cuttings are planted. In about a year, the stalks are twelve feet high and bear long green leaves. The light and heat of the sun help these leaves to form a rich sweet sap which flows from the leaves into the fibers of the stalks.

Many plants contain sugar. If we chew blades of grass or flower petals, we can taste the sugar in them. Sugar cane contains so much sugar that when the stalks are cut down and run through large crushing machines, every hundred pounds of stalk yields about eighty pounds of sugary sap. The water in the sap is boiled out; and as the sugar cools, it forms molasses and brown crystals. These crystals are 'raw' sugar.

The raw sugar is shipped from the mills near the plantations to sugar refineries in the United States, where, after more boiling and filtering, it forms white crystals which we eat as granulated sugar. In the sugar refineries these crystals are also made into powdered sugar, lump sugar, or pure brown sugar.

Thus cane sugar comes to our basket to add flavor and fuel value to our meal.

Table sugar is also made from the juice of the sugar beet which grows in Canada and in our own country in the western states and in the states near the Great Lakes. Many people like to eat a sugar which farmers make from the sap of the maple tree.

Spices

Now what is this, away down at the bottom of our basket? It is a small tin of black pepper. We turn the cap so that we can smell the spice. The pungent smell makes us sneeze.

Sailors sailing toward Java, Ceylon, and other islands near India are greeted by fragrant winds. The winds blowing from plantations on the islands carry the sweet, sharp scents

of pepper, cloves, and other spice plants to the ships at sea.

When the sailors land at the docks near the plantations, cargoes of the spices are brought on board. Some of the ships carry their fragrant burdens back across the Pacific to San Francisco, Seattle, Portland, and other cities on the western coast of the United States. Some come through the Panama Canal, a waterway which engineers from our country have cut through Central America. In this way, the spice ships reach the Caribbean Sea. They can then come north to deliver their cargoes to Mobile, New Orleans, and other cities on the coast of the Gulf of Mexico. Or they can come still farther north to bring their spices to Charleston, Philadelphia, New York, Newark, Newport, Boston, and other cities which are built close to the Atlantic. From the coast cities, trains carry the spices to the inland cities and to the farms.

So the basket from our grocer has many a story packed away in it. Each food plant was raised by workers in the climate which best suited it. Yet, as the boy unpacks the basket, it would seem as though the plantations, the orchards, the groves, the gardens of the world, all lie just outside our door.

Questions to Answer

1. Can you name all the things that you found in that wonderful basket you have just read about?
2. Can you tell where each kind of fruit came from?
3. Do you remember where the many different kinds of nuts came from?

4. Can you name and locate the American cities to which these came before reaching your grocer or fruit dealer?

Things to Do

1. Find on a map of the world all the places where the many wonderful things came from in the basket of plant foods you read about in this chapter.

2. On an outline map of the world trace with a blue pencil the route traveled by a cargo of bananas coming from Central America to New York City; a cargo coming from Colombia in South America to Boston, Massachusetts.

3. On the same outline map trace with a red pencil the routes traveled by sugar from Cuba to New York City; the route traveled by sugar from the Hawaiian Islands to New York City; from the Philippine Islands to San Francisco in California.

4. Locate on your map the following places: Java, Ceylon, India, the Hawaiian Islands, the Philippine Islands, Colombia in South America, and Cuba.

5. Locate on the same map of the world the American cities to which the many plant foods were sent.

6. Look at your map again. Do you realize how much of the world was busy either sending or receiving the many foods in that basket?

7. Make a list of all the fruits you saw in the basket; all the vegetables; all the nuts.

8. Make a collection of pictures showing each kind.

9. Make a collection of pictures of the places where these plant foods were raised.

10. Make a collection of pictures of the places where they were sent.

11. Make a list of the names of these foods for your spelling

lesson. Read the chapter again, so that you will not omit any important ones from your list.

12. If you don't know them, look up the meanings of these words:

filtering granulated crystals refinery

Chapter 16

WATER AND SALT

We have read of the foods which we get from plants. We have read of the foods which we get from animals. Now we shall read about salt and water, which are neither plant nor animal. They belong to the mineral department of the earth, which is our storehouse.

Some Uses of Water

Water helps us in many ways. We use water to bathe in. We use water for cleaning things. We use water to help us fight fire. But the thing for which we most need water is to quench our thirst.

All living things must have water. Without water no plant can live. Without water no animal can live. Without water we cannot live.

Fortunately there is a good deal of water in the world. Three quarters of the surface of the earth is covered by oceans.

We cannot drink the ocean water directly. It is salty, and when we are thirsty we want to drink fresh water, not salty water.

Yet much of the water which the people of the world drink, and the water which animals and plants drink, comes from the

ocean. The roundabout way in which the salty ocean water reaches people as drinking water makes an interesting story.

The Story of a Drop of Ocean Water

Each day some of the water on the surface of the ocean evaporates or, in other words, changes to vapor and mixes with the air. Water heated in a teakettle changes to vapor and mixes with the air. But water does not have to boil in order to evaporate. The air is like a sponge soaking up water vapor. Evaporation is going on wherever there is water for the air to soak up. That is why the wash on the clothesline gets dry. That is why the water in a dish placed on our window sill will disappear in a day or two. Air warmed by the sun will soak up more water vapor than cold air. When the moist ocean air rises, much of the vapor which the air has soaked up from the ocean changes to a fine mist. We see this mist as clouds.

Clouds are also formed through the evaporation of the water in fields and forests and inland lakes. But we are following the drop of water which is in a cloud which rose from the ocean. This cloud is carried on and on by the winds until it reaches a continent, where it drifts over valleys, plains, and mountains.

When a cloud reaches a place where the air is cold, the mist changes to water and falls to the earth as rain. When clouds come to very cold places, like the high mountains, the mist freezes and forms little crystals which fall to the earth as snow.

If we take a cold plate and hold it above the spout of our teakettle, the vapor will change to drops of water as it strikes the plate. In winter the water vapor which is in the air in our warm rooms changes to ice crystals when it strikes the cold window. These facts help us to know how the cold air of the mountains changes cloud mist to rain or snow.

When the rain from clouds falls on the mountains, much of the water sinks into the earth until it reaches a stony bed below. Then the water flows underground until it comes to a rocky place which blocks its course. Here it comes bubbling up through the earth as a spring.

Some of the winter snow which falls on the hills and mountains is melted by the warm spring sun. Much of this water and also much rain water rolls down the sides of the hills and mountains in gurgling brooks.

On their way downward, many small brooks meet and flow on together as larger brooks. Larger brooks meet and flow on together as rivers. Some of these rivers flow into inland lakes. Other rivers flow on and on through valleys and across plains until they come to the end of land, where they flow back into the ocean.

In all countries where the climate is not too cold, the water from the clouds, flowing through the land as rivers, helps plants to grow well. There are some places, like the deserts, where it seldom rains and there are no rivers. Only plants which need little moisture can grow on the dry desert sands. Two such plants are the cactus and the sagebrush,

which grow on the American desert in the southwestern part of the United States.

Today men are trying to turn a portion of this desert into farm land by digging ditches which will lead the water from distant lakes and rivers into the hot dry sands. This way of bringing water to help in farming is called *irrigation*.

Irrigation Makes Farm Land of the Desert

Besides helping plants to grow, the water making its voyage in a cloud gives drink to man and beast. People who live in wild country get water from springs and brooks and rivers. In some countries, water boys riding donkeys fill small bags with drinking water from the springs. Then they go into the cities, where thirsty people pay them for a drink. In our country, a farmer who lives where there is no spring near the house must dig into the earth until he strikes water. This water is rain which has trickled down through the soil

from distant hills to the rocks below. So the farmer gets his well. From this well he either brings up water in buckets or draws it up with a pump.

Bringing Water to the Cities

In the cities there are not enough springs to give all people water. People have no wells outside their homes. Yet many times every day those of us who live in cities turn on faucets, and the water flows, as if by magic. It took much labor and much thought to bring us the water which flows so easily. In some cities the water comes from the rain which fell on the hills and mountains miles away. To bring this water to these cities, engineers have built great reservoirs into which they have led the waters from the surrounding hills and mountains. These reservoirs are really artificial lakes which the engineers themselves have helped to form. Miles and miles of huge pipes lead the water from the reservoirs down to these cities.

All through a city and underneath the city streets there are water pipes through which the water from the reservoir flows into people's houses. Branch pipes lead this water from the main pipes in the streets into the cellars of houses. Pipes inside the houses lead the water from the cellars to the rooms above. This water supply is owned by the city. The owners of the houses pay the water department for the use of the water. This department uses the money to keep up the water supply.

What a long voyage the drop of sea water which we saw

started on its way has had to make from its home in the ocean, through its windswept journey in a cloud to the mountain where it fell as rain or snow, down the mountain side

Bringing Water to Your Drinking Glass in the City

into the reservoir, through the pipes, into your drinking glass!

But why is it that this glass of water does not taste salty? The water was salty when it was in the ocean. Why it is not salty now?

The answer is simple.

How Salt Got into the Ocean

When the sun shone down on the ocean and the water rose in a vapor to form mist and clouds, the salt was too heavy to rise. So the salt was left behind in the ocean. But this

answer only raises another question. How did the salt get into the ocean?

To begin with, we must remember that salt is a mineral which is part of the earth. There are places where rocks of salt lie on the surface of the earth. These places are called *salt licks*, because animals come to them to lick the salt which they need for food. But apart from these salt licks, there are small quantities of salt in much of the soil.

The rivers which come flowing through the land tear away much soil from the mountain sides and the river banks along their way. The rivers carry some of this soil and the minerals which it contains into the lakes and oceans. In this way the rivers have carried so much salt into the oceans that the ocean water has become salty.

In the United States there is a lake called the Great Salt Lake which is even saltier than the ocean. The Great Salt Lake is a shut-in lake, and the salt which is brought into the lake stays there as it stays in the ocean.

How Salt Reaches Our Tables

Our bodies need salt. There is salt in a few of the plants and in the meat which we eat, but there is not enough salt in these foods for our bodies. So workers have to get salt for us directly from the earth or from salt water.

One way in which salt is made for us is by evaporation. Salt water from salt lakes or from the ocean is run into huge basins, where it stands until all the water has passed off as vapor. This leaves a layer of salt. In many countries salt

is obtained in this way from the ocean water. In the United States much salt is made by evaporating water from Great Salt Lake.

Salt is also pumped up from salt wells. In places where the earth has stored up much salt, men dig wells and pump water down into the salt. Then they pump the water up again. When the water comes up, it is so salty that a gallon of water may hold two pounds of salt. This salty water is called *brine*. Evaporating the brine leaves the salt.

A third way of getting salt is by mining. When salt is dry, it forms crystals. We see small crystals in the table salt we use, but there are mines under the earth where salt is found in huge crystals which look like rocks. In a few places where men have found large deposits of rock salt underground, they have sunk shafts into the earth. In a salt mine, miners go down the shaft to chop the salt out in chunks. Then they load the rock salt on wagons which run along tracks in the mine to the shaft. Up the shaft goes the salt. From the mine the salt is taken to a near-by refinery, where it is made ready for our tables. The table salt which we eat comes from mines of rock salt.

Things to Do

1. Fill a shallow dish with water and put it on the window sill in your classroom. Watch it from day to day to see what happens to it.

2. Can you tell, from your reading about the water on the surface of the ocean, what does happen to water when exposed to the air?

3. When your doll has a washday, what happens to the clothes hanging on the clothesline?

4. Watch the puddles of water in your yard after a rainy day. Report to your class what happens to them.

5. Keep a record of the time it takes for similar puddles to disappear on a cloudy day and on a sunshiny day.

6. Be sure you know what these words mean and can spell them:

quench	reservoir	brine
evaporate	artificial	mist
engineers	chunk	irrigation

A Desert — How Would Irrigation Help?

PART IV

CLOTHING THE WORLD

CHAPTER

17. The Clothes We Wear
18. Clothing from Animals: Furs and Leather
19. Clothing from Animals: Wool and Silk
20. Clothing from Plants: Cotton, Linen, Rubber

Chapter 17

THE CLOTHES WE WEAR

Birds have feathers to protect their bodies against heat and cold. Fish are covered with scales. Many animals have thick hides or they have coats of fur or wool. Man alone of all the animals has to make clothes to keep his body from becoming either too hot or too cold.

Warm Clothes for Cold Countries: Wool, Leather, Fur

In the cold Arctic countries people wear furs all the year round. In temperate countries like our own where the winters are not so cold, people wear wool and leather as well as fur. These clothes we all get from animals.

Long ago hunters learned how to get furs and leather from animals; long ago farmers learned how to spin thread and weave cloth from the wool which grew on the backs of their sheep.

Cool Clothes for Warm Countries: Cotton and Linen

In the tropical jungles the weather is so warm that people do not need fur or wool. The jungle dwellers have no cold winds or snow to chill them, but because the climate is hot, they have to be careful that they do not become overheated.

They go about almost naked and rub vegetable oils on their bodies, so that the heat will not make their skins too dry. Such little clothing as they do wear, they make from plants, either from cool wild grasses or from leaves.

India is a warm country. A great part of India is in the tropics. Many of the people live in jungles. In India there are also farms and cities. Long ago the farmers in India learned to make a cool cloth from the fibers of a plant called the cotton plant. They drew threads from the cotton fibers and wove these threads into cotton cloth. This cotton cloth was cool; it was also strong, much stronger than the clothing which the jungle people made of grasses and leaves. It is believed that India was the first country to raise cotton for cloth. The cotton plant was brought from India to our country more than two hundred years ago.

Another strong cool cloth which people in warm countries learned to make from plants is linen. Even before the people of India learned how to weave cotton cloth, the farmers in Egypt knew how to make linen cloth from the flax plant. They raised flax along the banks of the Nile, and they spun linen thread and wove linen cloth from the fibers of the plant. The ancient Phœnicians taught the people of Ireland how to grow flax and how to weave linen. Today Ireland is famous for its fine linen cloth.

Silk

Furs, leather, and wool are warm and protect our bodies against wintry cold. Cotton and linen are cool and protect

our bodies against summer heat. There is another clothing material which is both cool in summer and warm in winter. This is silk. Silk was discovered by the Chinese more than four thousand years ago.

Silk cloth comes from a little caterpillar called the *silkworm* which feeds on the leaves of the mulberry tree. You may have raised silkworms in your school. How the Chinese learned to use these worms for making silk, we shall read later.

Today in our own country we wear furs and leather as did the hunters of old. We wear clothes made of wool. We wear linen clothes as the Egyptians did. We wear cotton clothes as the people of India do. We wear silk clothes as the Chinese do.

Indian Clothes

But the Indians who lived in this country before the white men came did not wear silk or wool or cotton or linen. They could not wear wool, because they had no sheep. They could not wear cotton or linen, because they did not raise cotton or flax plants; nor did they know how to raise silkworms and make silk cloth. Being without wool, cotton, linen, or silk, the Indians wore furs. They also wore leather clothes made from deerskin and buffalo hides.

When the white people came to this country, they brought woolen clothes with them. They learned from the Indians to wear deerskin. But they preferred to dress as they had dressed in Europe.

How Cotton, Linen, Wool, and Silk Came to America

As the newcomers did not want to buy all their clothes from the weavers in Europe, they brought over sheep and made their own woolen clothes. They brought over flaxseed, planted flax, and made their own linen. After a time some of the farmers in the southern part of this country planted cotton, from which cotton clothes could be made.

Then there came a time when ships built in the United States began to go on long voyages to China. When they returned, these ships brought back silk cloth to sell in this country. Today the United States imports raw silk, and the silk cloth is made here.

Now we know why we can wear wool and cotton and linen and silk in this country where the Indians had only animal skins for their clothes. This does not mean that the Indians did not know how to weave. They practiced weaving with different kinds of grasses long before cotton, wool, or silk were known in this country. Indian tribes living in those states which are now called Arizona, New Mexico, Nevada, southern Colorado, Utah, and western Texas made excellent coiled basketry, woven sandals, and bags made of woven twine hundreds of years before Columbus discovered America.

Things to Do

1. Make a collection of cotton, wool, linen, and silk materials used for clothing.
2. Plant some cotton seeds in your window box or flower pot.

3. Study the map of the world; locate the places mentioned in this chapter where linen clothing was first worn; where silk clothing was first worn; where furs were worn.

4. Print on an outline map of the world with a colored pencil the names of these places.

5. Ask your teacher to help you raise some silkworms in your classroom. If you feed them and watch them grow, you will see some very interesting things happen.

6. Make a collection of pictures showing the raw materials from which we get all the kinds of clothing mentioned in this chapter.

7. You have read in this chapter about people clothed differently from us; collect pictures of these people in their native dress.

8. Ask your teacher if she will help you weave a mat of raffia, which is a kind of grass used by American Indians for weaving mats and baskets. Perhaps you could weave a simple basket.

Chapter 18

CLOTHING FROM ANIMALS: FURS AND LEATHER

Long ago cave-dwelling hunters hunted in the wild forests for furs. Today, far away in the cold north countries, hunters still spend their lives hunting for the furs which men and women wear.

The animals which yield the best furs live where the winters are long and severe. The Arctic seal and the bear are fur-bearing animals. In Canada and in other lands, not quite so far north as the Arctic countries, live the otter, the beaver, the marten, the mink, and the fox. Their furs are thickest and best during the cold winter months.

Years ago there were many fur-bearing animals in our country, and men hunted and set fur traps in the forests which covered a great part of our land. Now that a great part of our forests are gone, we have to get most of our furs from Russia, from the Pribilof Islands, off the coast of Alaska, and from Canada.

The Life of the Fur-Trapper

The life of the Canadian fur-trapper is a lonely one. Bearing his traps on his back, he sets out each day from his little log cabin in the snow-covered forest. His broad snow-shoes keep him from sinking too deeply into the snow. In

each tree that he passes, he chops out a mark with his ax. Whenever he sees the tracks of a beaver, a mink, an otter, or a fox, in the snow, he stops to set one of his metal traps. Before dark, he returns; the ax marks in the trees guide him back to his cabin.

The next day he gathers the animals which his traps have caught for him. He resets the traps and, with pack loaded, returns to his cabin.

Here, stripping the furs from the animals, he stretches them on wooden frames.

So the trapper lives for months, far from the comforts of farm and town. His food is wild meat and canned goods. His companions are the birds and the trees. His music is the music of the forest winds blowing through the tall trees. As he looks out from his cabin door, he sees frozen streams in the valleys below and mountains raising their ice-covered summits to the chill blue sky above.

When spring comes and the rivers thaw, he loads his dried furs in his canoe and paddles to the nearest trading post some hundreds of miles away. At the trading post the trapper sells his furs. After a time he paddles his canoe back to his cabin, to mend his traps for the following winter.

The trader who has bought the furs sends them to the countries where they will be worn. Many of the Canadian furs are sold to the United States. In a few large cities in our country skillful furriers carefully clean the furs, dye them, and make them up into scarfs, muffs, coats, and trimmings for suits and dresses.

How many people who wear furs ever think of the lonely trapper in his little log cabin in Canada, of the men who hunt seals on the icy Pribilof Islands, of the men who set their traps in the forests of Russia?

Within the last few years men have found it possible to raise some animals for their furs instead of hunting or trapping the animals in the forests and streams. Foxes and muskrats are raised in this way, and the places where they are raised are spoken of as *fur farms*, just as the places where cows are raised for their milk are called milk farms, or dairy farms.

How We Get Leather: Tanning Hides and Skins

As a matter of fact, the cow, like the goat and the sheep, also helps to clothe us by furnishing us with leather. Our leather shoes, our leather gloves, our leather belts, come from the skins or hides of cows, sheep, and goats. The skins and hides of other animals are also used in making leather.

For thousands of years men knew how to make leather. First they scraped the flesh and hair from the hides. Then they laid the hides in vats filled with shavings of oak bark. They poured water over hides and bark. For six months the tannic acid in the oak bark soaked through the pores of the hides, toughening the animal skins so that they would wear well. This long soaking is called *tanning*. A tanned hide is called *leather*.

Today leather is still made in very much the same way, except that the tanners now use many machines in place of

hand tools and get tannic acid from other plants besides the oak tree.

Each year the American tanners buy millions of skins and hides from the meat packers in our country. They buy skins and hides from the sheep and cattle ranchers in Argentina. They also buy skins and hides from countries in South America, from South Africa, from China, and from Europe.

The leather of cows, horses, oxen, buffaloes, and bulls is called *hides;* that of smaller animals — calves, sheep, goats, and pigs — is called *skins*.

In the tanneries of today millions of hides are made into leather each year. Soaking the hides in a lime bath for days loosens the outside hair. A hand scraper removes the flesh from the inside of the hides. Because oak is now scarce, tanners use the bark of the hemlock and chestnut tree. The bark of these trees contains tannic acid. The tanners also import tannic acids which are obtained from plants growing in South America, Asia, Africa, and Europe. These acids are boiled out of the plants in the countries where the plants grow and are then shipped to our tanners in liquid form.

The tanners soak the hides in the tanning acids for at least three months. Sometimes the hides must be soaked for nine months before the leather is ready to be made into the many articles we use.

Many Uses of Leather

When the leather is finished, it is used for many purposes. It may be made into gloves, valises, suitcases, straps, or

harnesses. It may be used as upholstery, either for automobiles or for furniture. Much leather is used for machine belts which help to drive the wheels of factory engines. But the greater part of the leather from the tanneries goes into the making of shoes.

Leather: the Chief Shoe Material

In many foreign countries people used to wear shoes quite different from those worn in America. In Holland wooden shoes were worn. In China and Japan people wore straw sandals, and in fact many still do. But there is so much traveling in these days and so much mingling together of all peoples of the world that customs in dress are rapidly changing, and people the world over are beginning to dress more or less alike.

In these days leather shoes are worn the world over, except as fashions in shoes change to some other material. Shoes made of fabrics, such as satin, fancy silk, and velvet, are sometimes worn by women for dressy wear.

Canvas and rubber shoes are worn by people who play tennis, or other light outdoor games. But for everyday wear, leather shoes are the most serviceable, and that is why leather is one of the important materials in the making of our clothes.

Making Shoes: the Old Way and the New

In the days of our grandparents, the man who mended shoes made shoes as well. He made shoes by hand with the

aid of a few hand tools. But today shoes are made in cities where there are large shoe factories run by machines. Many of these factories are found in the cities of New England. There are very large shoe factories in other parts of our country.

In these shoe factories the work is divided. One machine cuts the leather for the upper part of the shoe, another punches the buttonholes, another shapes the soles and sews the upper parts to the soles. Each machine does some one part of the work. The man who tends the machine has only to guide it at its special task. Finally all the parts are put together, and the shoes are finished.

The Travels of a Pair of Shoes

Our shoes can carry us many a mile. But what long journeys had to be made before we could have our shoes! The herds which furnished the leather in your pair of shoes may have grazed either on the southwestern plains or in the corn belt of our own country; they may have spent their lives on the plains of Argentina. Boats or trains had to carry the animals to meat-packing cities, and the hides to tanneries. Carloads and shiploads of oak, hemlock, and chestnut had to be sent to the tanneries. Ocean ships had to bring tannic acid from all corners of the earth. After the leather was tanned, it had to be sent to the shoe factories.

Yet the travels of your pair of shoes were not over. There was still the journey by railroad, steamship, or automobile truck to the stores from which you bought them.

Now that you have them on your feet, you will walk many miles in your home, along country roads or city streets.

Looking down at your shoes, you will remember the traveling they did before they reached you. They will re-

The Travels of a Pair of Shoes

mind you how the whole world must work together to provide the things we need.

Questions to Answer

1. Name the most important fur-bearing animals.
2. How are the different kinds of fur-bearing animals caught?
3. Where do we get our leather clothing? Can you name articles of clothing made of leather?
4. How has the making of shoes changed since our great-grandfather's day?
5. Although this chapter doesn't tell you, can you find out where your own shoes were made?
6. Why do the children in some places wear wooden shoes instead of leather ones?

Things to Do

1. Locate on your outline map the places all over the world where fur-bearing animals live.

2. Locate on the same map the countries from which we buy leather.

3. Locate the countries where cotton is grown; where silkworms are cultivated; where sheep are raised; and where flax is grown.

4. Make a list of the kinds of clothing made of leather, of silk, of cotton, of wool, and of linen.

5. If you live near a shoe factory, plan a visit to see how shoes are made.

6. Write the story of your visit in your notebooks.

7. Study the words in the list below. If you are not sure of the meaning of each word, read the paragraph in which you found it; then see if you cannot decide what it means.

trapper	upholstery	picturesque
companion	tannic acid	fashionable
scraper	tanneries	serviceable
factory	fabric	stripping
vat	muskrat	furrier

Chapter 19

CLOTHING FROM ANIMALS: WOOL AND SILK

All of us who live where the winters are cold wear woolen clothing. Our sweaters are made of wool; we have woolen suits and woolen overcoats, woolen stockings, woolen underclothes.

Some of our wool comes from sheep raised on small farms in the eastern and middle states of our country. Some wool

Growing Coats of Wool

comes from the sheep ranches in the southwest. We get great quantities of wool from sheep raised in the mountainous states on the Pacific coast. We even import wool from Australia, Argentina, and other countries.

Grazing Sheep Grow Coats of Wool

In the western states of our country, all through the winter millions of sheep graze in the valleys. When summer comes, the sheep herders lead their sheep up into the mountains.

The office of the sheep herder is a little wagon on wheels. Here he keeps his tools, his food supplies, and his extra clothing. Here, when it rains, he and his shepherd dogs find shelter. At other times the herder sleeps under the open sky, rolled up in his blanket.

His dogs help the herder round up the sheep, but try as they will to keep the sheep together, some wander off and get lost. When the bleating of lost sheep reaches them, the herder and his dogs go out to bring them in.

Each day the herder leads his sheep higher and higher, up toward the timber line, beyond which it is too cold for trees to grow. In the summer wild grass does grow in these high places, on mountain plains which are called *plateaus*. Day by day the sheep graze here; and as they graze, they grow their woolen coats to protect them against the coming winter.

When autumn comes and the mountain grass is gone, the herder leads his sheep down into the valleys. In the spring the shearers clip off the sheep's wool.

So men have been shearing sheep ever since the farmers of long ago first learned to make thread and woolen cloth from wool.

How Woolen Cloth Is Made

Just how men learned the art of weaving, we do not know; but they did learn that the wool from their sheep could be spun into long threads and that these threads could then be woven into cloth. Many believe that women were the first spinners and weavers.

The weaving of cloth was done on a hand loom, a wooden frame in which many threads were arranged in parallel lines lengthwise. Then other threads were drawn sidewise over and under the lengthwise threads. The sidewise threads were drawn through the other threads by a long stick called a *shuttle*.

Whether wool was first woven by the Egyptians or the Greeks is uncertain, but it is known that the sheep has been a domestic animal from prehistoric times, for its bones have been found with those of human beings in ancient tombs.

There are some parts of the world where people still spin woolen thread or yarn by hand or on small spinning wheels which draw out one thread at a time. They still weave woolen cloth on hand looms.

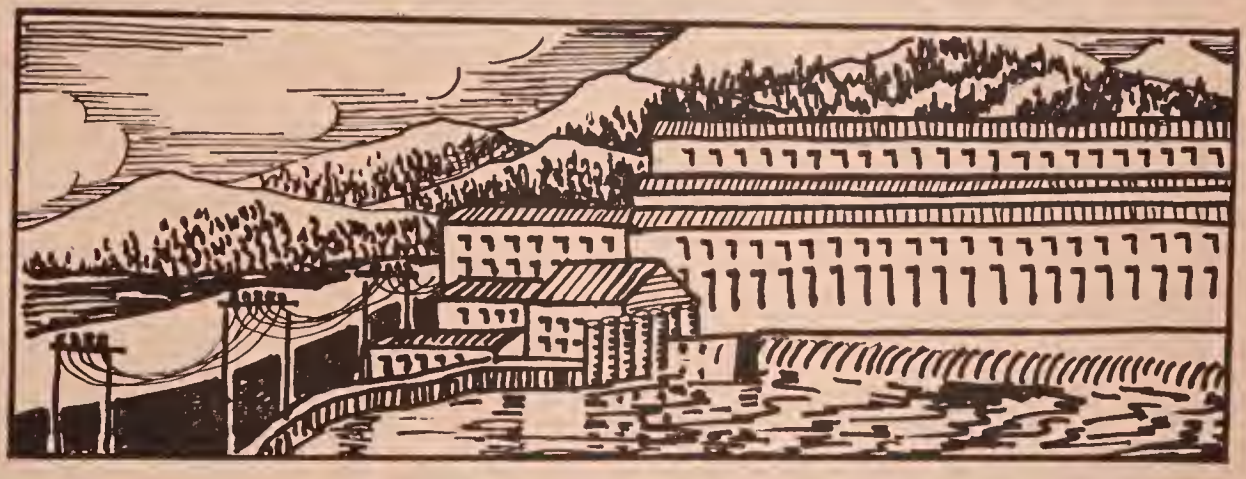
In our country the wool from the sheep ranches is sent in bags to woolen mills, where great machines made of iron and steel spin the yarn and weave the cloth.

In the woolen mills, machines first scour the wool. Often, after the scouring the wool is dipped into vats of dye to give it whatever color is desired. Then the wool passes through carding machines. These machines have rollers armed with

teeth which pull at the fibers in the wool to separate them. The carded wool is combed by combing machines, which remove the shorter fibers.

Now the wool is ready for the spinning machine. The spinning machine has two hundred spindles on a single iron frame. These spindles draw out the thread or yarn which is wound up on spools.

Then comes the weaving of the cloth. After the lengthwise threads have been arranged, the power loom weaves the



A Factory Built near Water Power

wool almost without the touch of human hand. As the shuttle flies back and forth, the lengthwise threads are raised and lowered, to make plaids, stripes, or herringbone.

You would need to visit a woolen mill, probably, to understand clearly just how scouring, dyeing, carding, combing, spinning, and weaving are done, but you can at least understand now that to make woolen cloth, men have to know how to make and to run many different machines.

In this country, there are many woolen mills in New England, where rivers help furnish power for all this machinery.

There are also woolen mills on the Pacific coast and in the southern states, close to the herds of sheep which graze on the mountain plains. England, too, has many woolen mills.

Almost all of us wear clothing made of wool. As our country does not produce enough wool for our clothes, we import wool from other sheep-raising lands such as Australia, and Argentina in South America.

Ready-Made Clothes

Most of our woolen clothing is made in clothing factories in New York, Rochester, Chicago, and a few other large cities. In these clothing factories there are, again, many machines. Machines cut the woolen cloth; machines sew the goods; and machines press the goods.

The most useful of these machines in the clothing factory is the sewing machine. Until this machine was invented, people all over the world sewed clothes by hand. Stitch, stitch, stitch, tailors and dressmakers sewed for hours each day, and the dresses and suits which people wore were all handmade. Most often they were made to order for the man or woman, boy or girl, who had to wear them.

Your great-grandmother probably made all the clothes for her children by hand, for she could not go to the store and buy them ready-made as your mother can. Then, about the year 1846, Elias Howe, an American, invented a sewing machine which used foot power to work a needle much faster than fingers could stitch. This was a great help to tailors and dressmakers.

Today in the clothing factories sewing machines using steam or electric power can make hundreds of stitches each minute and turn out more garments in a day than the hand sewers could turn out in a month. For this reason most people today wear 'ready-made' clothes, or, in other words, clothing made in factories. These ready-made clothes come in many different sizes to fit people who are either short or tall, slim or stout.

Now that we have seen how woolen cloth is made, we shall find it easy to understand the making of silk cloth.

We have seen how the sheep, eating grass, turns part of its food into a woolen overcoat. In much the same way a little worm called the *silkworm*, eating mulberry leaves, turns part of its food into a fine sticky substance which it stores up in two sacs, one on each side of its head.

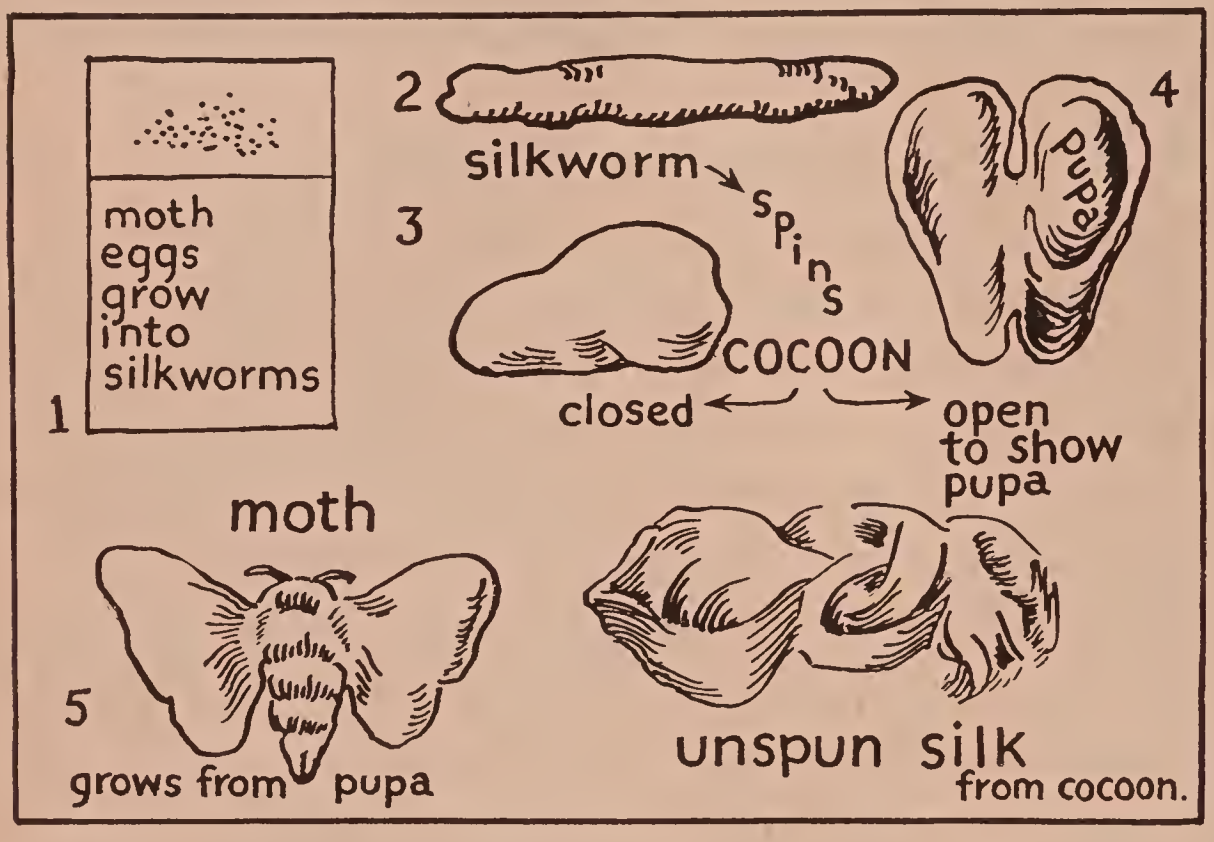
When the silkworm is one month old, it draws this substance out of its head in two fine threads and winds these threads around its body.

The Worm Which Helps to Clothe Us

When the body of the silkworm is covered with the threads, we call it a *cocoon*. If the cocoon is left to itself, the silkworm inside gradually changes, until after a time it breaks open the cocoon and comes out as a moth. But long ago the Chinese decided not to let all the cocoons change to moths. They learned that if they soaked a cocoon in hot water, they could uncoil the fine threads which the silkworm had spun around itself. This thread is called *raw silk*. By

twisting the threads of several cocoons together as they uncoiled them, the Chinese obtained a thread strong enough to weave into a cloth on their hand looms.

How the Chinese learned to use these worms for making silk is an interesting story, though no one knows how true it is. A Chinese princess with the lovely name of Lady of



Li Ling encouraged the people of China to grow the mulberry tree. She took care of silkworms herself. She invented the loom for weaving silk into cloth. The people of China were so proud of her that they made her a goddess. They still worship her as the Goddess of Silkworms. Every year the Chinese people have a festival in her honor. One of the ceremonies of this festival is the feeding of silkworms.

A curious story is also told about how India learned to make silk. Another Chinese princess is believed to have car-

Gathering Mulberry Leaves to Feed the Silkworms

ried into India the eggs of the insect, or moth, and the seed of the mulberry tree, hidden in the lining of her headdress.

Today silkworms are raised in Japan, China, France, Spain, and Italy. In all these lands, mulberry trees are raised. People feed leaves to the worms and care for them until the cocoons are ready. Some of the silk spun from the cocoons is woven into cloth in these same lands; the remainder is shipped to other countries as raw silk. Within the last hundred years, ways have been found to spin and weave silk by machinery.

The United States imports silk cloth from China and Japan. It also imports raw silk, which is woven into cloth in factories in this country.

Rayon: Man-Made Silk

There is another kind of silk called *artificial silk,* or *fiber silk.* This silk is made from wood pulp and the fibers of certain plants. About a century ago, a Frenchman discovered how to make an artificial silk which is now commonly called *rayon.* Rayon is now made in the United States as well as in other countries. The rayon thread can be woven by itself into the cloth called rayon, or it can be mixed with wool, cotton, or pure silk. Rayon is less costly than pure silk and for this reason large quantities of it are used today in the making of clothing.

A Test to Try

Can you write in each blank the missing word or words which make the statement correct?

1. Sheep raising is carried on in the _____ part of our country.
2. _____ were the first spinners and weavers.
3. Woolen cloth is no longer woven by _____.
4. There are many woolen mills in the _____ section of the United States. This séction is called _____ _____.
5. The United States imports wool from _____ and _____.
6. The first sewing machine was invented by _____ _____ in the year _____.
7. The _____ were the first people to learn the art of silk weaving.
8. The United States imports silk from _____ and _____.
9. A _____ discovered how to make artificial silk.

Things to Do

1. Make a chart showing all the different kinds of wool and silk which you read about in this chapter.
2. Locate on your outline map of the world all the places mentioned in this chapter.
3. Write the name of the product for which each place is noted.
4. Draw on this map a dotted line with your blue pencil showing the trade routes over which these goods are shipped.
5. Be very sure you know the meanings of the following words and phrases:

artificial silk	loom	prehistoric times	festival
plateaus	shuttle	domestic animals	cocoon
spinning	scour	ancient tombs	mulberry
weaving	carding	Lady of Li Ling	carding machine

6. In the first column below you will find a word that is connected in meaning with some word in the second column. Put the same number in front of the connected word.

1. artificial silk	sheep
2. silkworm	Elias Howe
3. shearing	Chinese princess
4. sewing machine	China
5. silk weaving	Australia
6. wool	rayon

Chapter 20

CLOTHING FROM PLANTS: COTTON, LINEN, RUBBER

A girl is getting ready to go to school on a warm, rainy morning. She is wearing a cotton dress, with linen cuffs, and a linen collar. She is putting on her rubber overshoes. Before leaving home, she will put on her rubber raincoat.

To provide the girl with her dress, her overshoes, and raincoat, the cotton plant, the flax plant, and the rubber tree had to take root in the earth.

Cotton: the Cloth Made from a Fluffy Seed Pod

The plant on which cotton grows needs a warm climate and well-watered soil. In our country there are cotton plantations in almost all the southern states from the Atlantic coast to Texas. This region is called the *Cotton Belt*.

In the spring the cotton seed is planted. By summer the cotton bushes blossom. As the bright blossoms fall, small seed pods appear in their places. All through the summer the seed pods grow until they become large *bolls*, as they are called. When these bolls burst open, we can see that each one is filled with a fluffy mass of hairlike fibers wrapped around the small seeds as if to keep them warm. These white balls of fiber are cotton.

In harvest time field workers pick the cotton from the bolls. These cotton pickers must be careful not to get either leaves or boll shells into their picking.

Wagons carry the picked cotton from the fields to the gins where the seeds are removed. In the cotton gins, revolving metal combs remove the seeds. The cotton gin was invented in 1793 by an American named Eli Whitney. Before the cotton gin was invented, men used to remove the seed by hand, and they could clean about one pound of cotton in an hour. The cotton gins of today can clean one hundred pounds in an hour.

After the seed has been removed, great machines press the cotton into five-hundred-pound bales. Wagons haul the bales to railway stations or to river docks. Ships and trains then carry the bales on their way to the cotton mills where cotton cloth is made. Much of the cotton is shipped to mills in New England where waterfalls furnish power for the spinning and weaving machines. New England was once the center of cotton weaving, but during the past fifteen years men have built many cotton mills near waterfalls in the states which lie in the cotton belt. The cotton planters send much of their cotton to these mills, which are nearer to them than the mills in New England.

Making Cotton Cloth

In the mills the great bales of cotton are first put into machines which pull the closely packed cotton apart and deliver it in small tufts to a moving belt. This belt carries

the cotton to other machines which clean the fibers and prepare them for the spinning machines.

The spinning machines draw out the fibers and twist them into long threads. It is this twisted thread which we buy when we buy a spool of cotton and which is also used in weaving cloth. If we untwist the thread on a spool of cotton we can easily see the fibers of which it was made.

The power looms which weave the threads into cotton cloth are much like the looms which weave woolen cloth. The machines work as if by magic. The shuttles carry the sidewise threads over and under the lengthwise threads in any order which the clothmaker desires, to weave cloth of different patterns.

The cotton cloth is then bleached until it is pure white. If colored cloth is wanted, the cloth is dyed in vats. If colored patterns are desired, they can be either printed on the cloth by printing presses, or woven into the cloth from dyed thread.

Long ago the Chinese learned how to print patterns from carved wooden blocks filled in with colors. Today the patterns are put on copper rollers. As the printing presses run, the rollers dip into a well of color. A knife scrapes the color off the raised flat part of the copper. The roller presses down on the cloth and prints the pattern on it.

The cotton dress which the girl is wearing may have been made for her by her mother, but most of the cotton dresses and other cotton clothing which people wear today are made in clothing factories.

Linen: the Cloth Made from Plant Stalks

The story of linen is much like the story of cotton, except that linen thread is made from fibers in the stalks of the flax plant.

The flax plant needs a cooler climate than the cotton plant. It needs plenty of rain. Good flax is raised in Belgium, Holland, and Ireland. Russia has great flax fields. The United States raises flax, too, but our flax is raised for the seed. Flaxseed is used in making linseed oil for mixing paints.

Flaxseed is planted in the spring. By June the fields of flax are covered with sky-blue flowers. In the early autumn, when the plants have borne seed for next year's crop, men pull up the flax stalks, which are about three feet high, and tie them in bundles.

If we examine the stems of almost any flowers, we can see fine fibers running through them. We notice that the outer fibers are coarse and woody.

The stalks of the flax also have fine and coarse fibers mixed. Linen is made from the fine fibers in the flax stalks.

To remove the fine fibers, the bundles of stalks are lowered into streams and kept in water until they begin to rot. After the stalks have rotted, the bundles are taken from the streams and laid out to dry. Then machinery breaks up the stalks and removes the heavy wooden fibers.

The fine fibers are now prepared so that spinners can draw threads from them for weaving linen.

Until about one hundred years ago, most linen was spun and woven by hand in the homes of spinners and weavers. Today most of the spinning of linen thread and the weaving of linen cloth is done in factories by machines; linen clothes are also made by machines in factories.

Now we see how the girl mentioned earlier in this chapter got her linen cuffs and her linen collar.

Rubber: the Sap of a Tree That Helps to Clothe Us

The rubber overshoes and the rubber raincoat which she is wearing is made from a liquid which oozes out of the bark of certain trees. The rubber tree grows best in tropical countries or in countries which are nearly as warm as the tropics. We import all our rubber.

For a long time almost all the rubber which people used was obtained from jungles along the Amazon River in Brazil. Lately, rubber companies have been clearing jungles in the islands near India. Here they planted many square miles of rubber trees, and today these plantations supply a large portion of the world's rubber.

To obtain rubber from the rubber tree, men cut slits into the bark and they place cups to catch the sticky, white juice which flows from the wounds. This is called tapping the trees and is very much like tapping trees for maple syrup. In the Amazon jungles the Indians of South America do this work. The men tap many trees each morning. Then they go over their ground to gather the cups. The jungle rubber

is smoked and hardened over fires, so that it can be shipped in lumps.

Some of the plantation rubber is shipped in liquid form. Boats bring great cargoes of rubber to the factories in our country.

In the Amazon jungles the season for gathering rubber begins as soon as the floods of the Amazon River are over. This is usually about the first of August. The natives leave their primitive homes, often traveling hundreds of miles

The Jungle Rubber Is Smoked and Hardened over Fires.

into the forest lowlands. There, within easy reach of the rubber trees, they set up their camps. They build huts out of poles covered with palm thatch, and here they live in little colonies while the rubber harvest is going on. It takes about six months (from August to January or February) to harvest the rubber crop.

People did not always know how to use rubber for clothes. When white people first came to Central America and South America, they saw the Indians playing with balls made of rubber. After a time some men noticed that this material sheds water. But for a long time rubber was used for little

Tapping Trees on a Rubber Plantation

more than erasers. This continued to be true until Charles Goodyear, an American inventor, who had been experimenting with rubber, made an important discovery. He learned by accident that rubber and sulphur, heated together, would stay soft in cold water and would not become soft and sticky in warm weather. Many uses were soon found for this prepared mixture of rubber and sulphur, which is called *vulcanized rubber*.

Today rubber is used in making automobile tires, machine belting, garden hose, and the hose with which firemen fight fires. Rubber parts are used in many tools and engines. Because rubber sheds rain, rubber is used to make shoes and coats to be worn on rainy days. Rubber shoes and coats are made in factories by machinery.

Now we know how the girl we described at the beginning of the chapter got her overshoes and her raincoat.

Things to Do

1. Locate on your outline map of the world, the countries in which flax is raised. Write the word flax near the name of the country.
2. Do the same thing with cotton; with rubber.
3. Make a list of all the things you can think of made of rubber; see how many of them you can get together for a collection.
4. Make a collection of different kinds of linen and cotton goods.
5. If you arrange all the samples of materials which you bring to class on charts, you will have a very interesting exhibit.
6. Your exhibit will be even more interesting if you write

short compositions telling what you know about these samples. Some of the important facts you might write about are: the raw materials from which they are made; where they are found; what kinds of useful articles they are made into.

7. You might collect pictures of the different peoples of the world who are engaged in cultivating cotton, flax, and rubber.

8. Find out what linseed oil looks like; what it is used for; how much it costs.

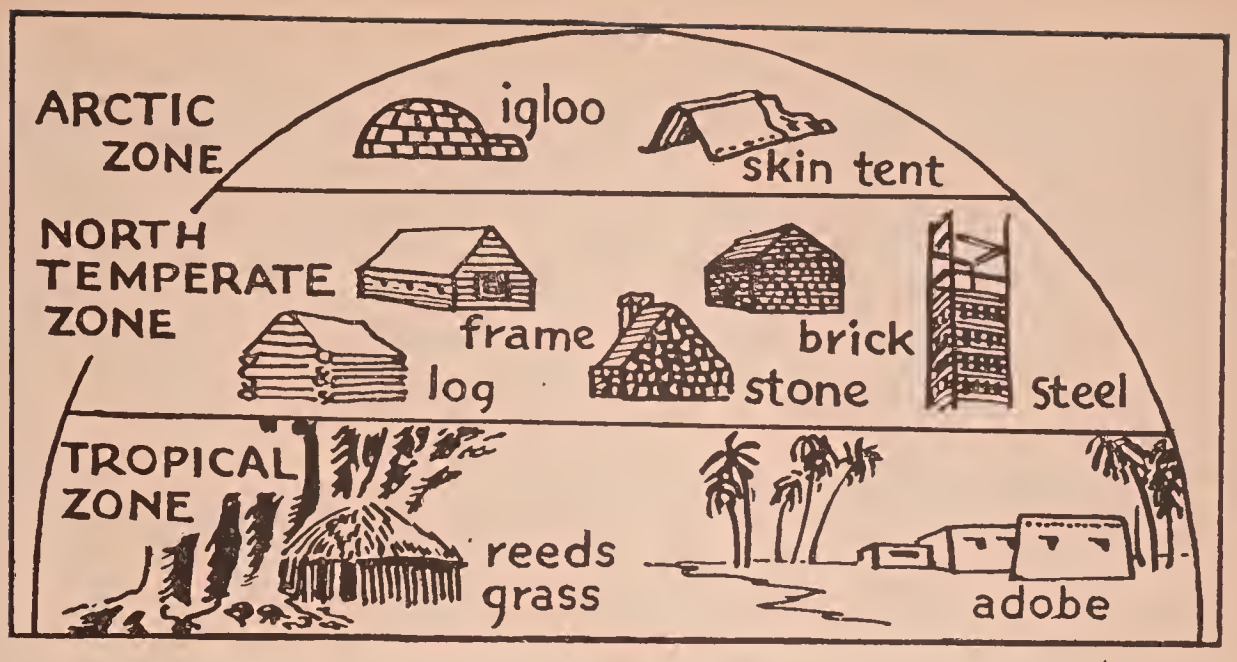
9. Check up to be sure that you know the meaning of these words: *import, ooze, primitive, thatch;* also that you know the difference between *ball, boll,* and *bale.*

PART V

HOMES THE WORLD OVER

CHAPTER

21. The Story of the House
22. Materials for Building the House
23. Furnishing the Home



Chapter 21

THE STORY OF THE HOUSE

Whatever language people may speak, one of the words which is dearest to them is the word which means *home*.

The birds in the air build nests. The fox digs himself a burrow in the ground. The beaver builds his home in a lodge in the middle of a stream. So, too, from the beginning man has had to make a home to shelter him.

Houses of Long Ago

The hunters of long ago found shelter from bad weather and protection from wild animals in their caves. The nomad herders lived in skin tents which they could carry with them from place to place. When men became farmers, they built houses near their fields.

In Egypt farmers learned to make bricks from clay, and they used these bricks to build their houses.

When the Egyptians learned to make metal hammers and chisels, Egyptian builders used these tools to cut stone into huge building blocks. With these huge cut stones they built the pyramids. Later the people in Europe used marble, granite, or other hard stones to build temples, cathedrals, and other large buildings.

But the people on the farms and in the towns of Europe continued to live in simple houses which took less time to build. Many people lived in houses built of stones which they picked up from their fields. They roofed these houses with thatch, which is usually a mixture of mud and straw. Such houses can still be found in European villages.

In some lands where stone was scarce, people built their houses of adobe,[1] which is a sort of sun-dried mud brick, laid up to make a wall and often then covered with white plaster. Such houses can still be seen in southern France and in Spain.

In countries where wood was plentiful and cheap, many people built themselves wooden houses, first sawing the trees into boards. In Switzerland, which lies east of France, we could see many picturesque wooden houses, called *châlets*,[2] in which the Swiss farmers live. The wood for these houses is cut from the forests which grow on the slopes of the Alps Mountains.

[1] A Spanish word, pronounced *ah-dough'beh.*
[2] A French word, pronounced *shah-lay'.*

In the Few Warm Months Eskimos Live in Tents Covered with Animal Skins.

How Builders in Each Land Use Materials at Hand

In Iceland and in Greenland, the Eskimos often build themselves wooden houses from driftwood brought in by the ocean. In the few warm months which they have, other

A Grass House in the Tropics

Eskimos live in tents covered with animal skins, but in the long cold winters most of them live in snow houses built from cakes of snow.

In some tropical countries men build their homes of reeds and grasses.

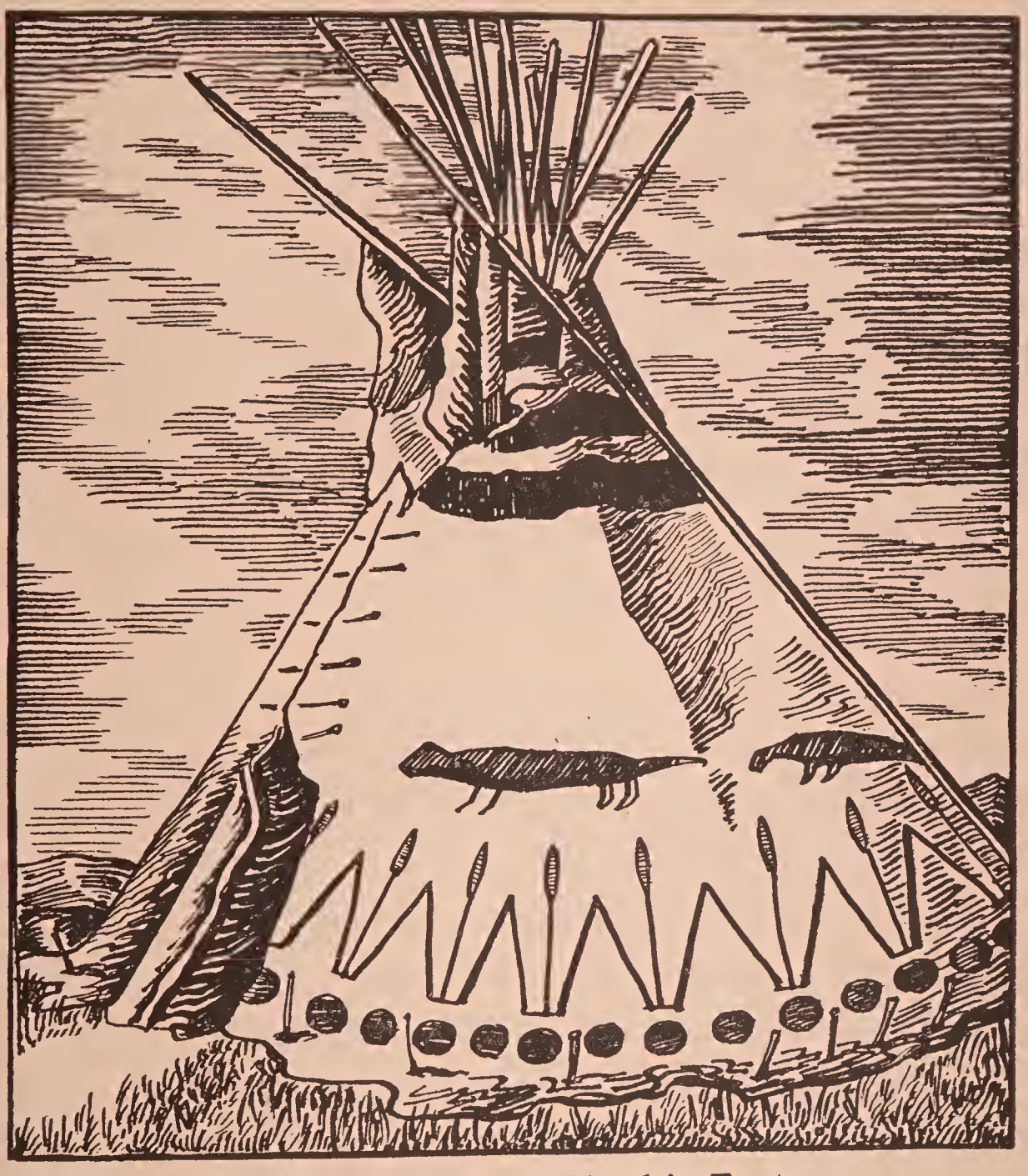
When the white people came from Europe to America, they found the Indians living in different kinds of houses. The Indians in the tropical parts of America lived in grass houses. In some warm parts of our country, the Indians lived in adobe houses. The Indians who hunted buffalo on

In the Southwestern Part of the United States Some Indians Lived in Adobe Houses.

the grassy plains or prairies in the West lived in tents. The Indians along the Atlantic coast lived in houses made of rough logs.

The white men who settled in the part of America which is now the United States built their first homes of logs, as the neighboring Indians did. Later they began to build frame houses of boards. At first they cut these boards out of logs with handsaws. Then they built lumber mills on the banks of rivers, and used water power to work their saws.

After a time, when many of the white people lived in towns, a few men built themselves brick houses. The bricks



The Prairie Indians Lived in Tents.

were either made here or imported from Europe. In some places people used field stone to build churches, forts, and even homes.

As the white men went westward across America, their first shelters were rough log cabins. Then came wooden frame houses and brick houses.

Why There Are Apartment Houses

Until about fifty years ago many of the people in this country lived on farms, and each farmer lived in a separate house of wood or brick or field stone. In these houses people were still doing much work by hand which was soon to be done in the city factories by machinery. As the factories took over more and more of the work which used to be done in the home, the cities grew more crowded. People who worked in the cities and who wanted to live as near to their work as possible had to live in houses which would hold three or four families.

Then as the cities grew still more crowded, houses were built to hold twenty or thirty families. Today in some cities there are houses which will hold hundreds of families. These houses are called *apartment houses.*

Apartment houses are built of brick and steel. City factories are also built of brick and steel.

In a few cities many men work each day in office buildings which are twenty, thirty, or even forty stories high. These skyscrapers are built of steel. In the next chapter you will learn how these high buildings are constructed.

A Test to Try

Can you write in the blank spaces in the sentences below the word or words which make these statements correct?

1. The Egyptians built the _____ of _____.
2. The Indians in the hot parts of America lived in _____ houses.

3. The earliest American homes were built of _____.
4. Many houses today are built of _____ or _____.
5. Apartment houses are built of _____, _____, or _____.
6. Very high buildings, having many stories, are called _____.
7. Many early Indians of the _____ part of our country lived in homes called _____.
8. Hunters of prehistoric times lived in _____.
9. Herders of prehistoric times were _____. They lived in _____.

Something to Do

1. See whether you can find pictures or make drawings of these kinds of houses:

a skin tent	a Swiss chalet	a log cabin
a thatched roof	an Indian tepee	an apartment house
an adobe	an Eskimo igloo	a skyscraper

Chapter 22

MATERIALS FOR BUILDING THE HOUSE

Looking about us in our homes, we see that the doors, the window sashes, the floors, are made of wood. All through our country, in twenty million homes and more, builders have used wood.

How Wood Is Obtained for House Building

Forests, supplying wood to builders, once grew thickly over the greater part of our land. Today a large portion of our woodland is gone. The trees have long since been cut down to make room for fields and towns and cities. Where, then, do the builders of today get wood for our houses?

Much wood comes from forests in the western part of the United States. Here, on the sides of mountains and on the wooded plains, trees grow thick and tall. Much wood comes from forests in the southern states, from the Atlantic coast to the Gulf of Mexico. There are forests in the northern part of New England and near the Great Lakes. A good deal of our wood is imported from the forests of Canada.

Let us picture a winter in a lumber camp in Canada. Snow is on the ground. But the spruce, the hemlock, the fir, and the pine which grow in the forest are green. They belong to the family of evergreen trees, which are green all the year round.

The lumberjacks who work at logging live in small cabins. One man cooks for all the men. Each day the forest resounds with the clang of their axes or the buzz of their saws. An ax hews out a notch in a tree. The cross saw, worked by two men, cuts its way through the heavy trunk; and the tree comes crashing to the earth. In a few months this part

The Logs Are Floated Downstream to the Lumber Mills.

of the once green and beautiful forest will be no more. The lumberjacks will move on to build a new camp some miles away.

But chopping down a forest in Canada does not bring the wood to our homes. What happens next?

The trees are stripped of their branches. They are sawed into logs. The logs are drawn to the edge of the nearest river. Here they are arranged in piles.

Then, when spring comes and the ice thaws, the logs, tens and tens of thousands at a time, are floated downstream to

the lumber mills. The men who guide the logs on their journey are called log drivers. See them out on the river, jumping from log to log. Spiked shoes keep the log drivers from slipping. They use long poles tipped with iron hooks to help drive the logs before them.

At one point near a bend in the river, the logs get caught and begin to jam. Before the log drivers can reach the spot, the jam is too large for them to pry the logs apart with their poles. The foreman gives the order to use dynamite. When the dynamite explodes, the jam breaks and the floating forest continues downstream on its journey to the mill.

The work of logging is not the same in all forests.

In the snow-covered New England forests, the same methods are used as in Canada. But in the warm southern states, where the yellow pine grows, the men cut the trees all the year round and the logs are hauled to the railroad on cars drawn by oxen or tractors. Sometimes the logs are sawed into boards by portable mills which are set up near the standing forests.

In California, where the giant redwood trees grow, it takes a long train of cars to remove a single tree. Each car carries one of the heavy logs.

In the mountain lumber camps of the West, the logs are cut into boards and the boards are put on flumes, which are wooden slides miles long. Water flowing down the flumes carries the boards to the valleys below.

Sometimes loggers working near broad rivers make a raft of the logs by fastening great numbers of them together with

iron chains. Then, living aboard the raft, the men help float it to the towns where the lumber mills are.

In the lumber towns, machines carry the logs into the mills. Inside a sawmill, machines carry each log forward against a machine saw. With an almost deafening noise, the saw cuts its way through the log from end to end. Next, the log is pulled back and turned on to its flattened side. Again it is pushed toward the saw. Again the saw does its

A Flume Carrying Lumber

work. Then a third time and a fourth, the saw cuts through the log, making it a square post or beam. Some of the beams are cut into boards. The small strips which have been sawed from the log are used for making thinner strips of building wood called *lath*.

In planing mills, machine planes give the boards a smooth finish.

From the sawmills the wood is now carried by boat or train to the lumber yards nearest our homes. Some of the lumber is used in the factories where men make furniture. Some of it is bought by the men who build our homes.

Brick Is a Good Building Material

Although we all have wood in our homes, many of us live in houses which have walls made of brick. Brick is a good building material. Brick is fireproof and is therefore safer than wood for large city buildings. Apartment houses, where many families live, must be made as nearly fireproof as possible.

Bricks are made of clay. In places where there is the right kind of clay, brickyards are built. In a brickyard, workers loosen the clay with tractors. They use machine shovels to load the clay on cars, which are drawn to the clay mill by an engine. In the mill machinery grinds the clay to a fine powder. Machinery kneads a mixture of the ground clay and water. Machinery cuts the clay into bricks.

All these things which the brickmaker of today does by machinery, the Egyptian brickmaker did by hand. The Egyptian baked his bricks in the sun. Today the bricks are baked in a huge *kiln*, or oven, which can hold thousands of bricks. The bricks are then loaded on barges and sent on their way from the brickyards to the builders.

Stones Are Mineral Building Materials

Wood is a plant material which helps the builder. Clay is a mineral which helps the builder. Stones which are also mineral are used in building. The stones most used in buildings today are granite, sandstone, slate, limestone, and marble.

SOME BUILDING MATERIALS

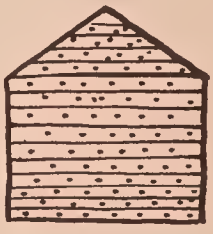
LUMBER

BRICK

STONE

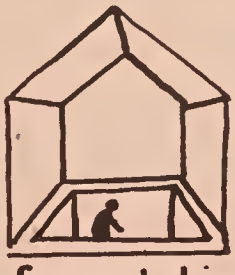
GLASS

WALL BOARD



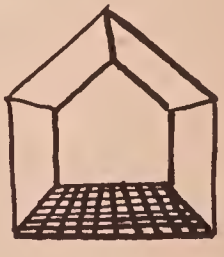
IRON NAILS

PAINT



foundation walls

CONCRETE



TILE

Marble is a beautiful stone, but it does not stand rain or snow well. Builders in our country therefore use it mostly for the inner walls and stairways of buildings.

Granite is hard and durable. Builders use granite for building foundations and for the outside walls of buildings. They also use sandstone, limestone, and slate.

In parts of the world there are large stores of marble, granite, and other stones. In these places men cut large blocks of stone out of the mountain sides or out of pits in the earth.

The mountains of Carrara in Italy are almost solid marble. In our own country many of the mountains in the northern part of New England are rich in marble and granite. A place from which stone is cut is called a *quarry*.

In a stone quarry men use machine drills to bore deep holes into the rocks. These holes are charged with dynamite, and the explosions loosen the boulders. Stonecutters trim the rough stone for shipping. The trimmed stones are then hauled down to the railroad station or the river. The transportation of freight by water costs less than transportation on land. For this reason the heavy stones are usually shipped by water on barges for as much of the way as possible.

In building with brick or stone, builders use a mixture called *mortar*. This mortar is made by adding sand and water to cement. Wet mortar put between the bricks or stones acts as a binder, holding them together. When the mortar dries, or sets, it becomes hard and helps make the wall strong and durable.

Today some builders use another material to take the place of brick or stone. They build with concrete. Concrete is a mixture of cement, crushed stone, and water. The cement is made from lime and clay, baked and then ground into a very fine stone flour, or powder. This powder, crushed stone, and water are then put into a mixer made of steel. When this whole mass is thoroughly mixed, it becomes concrete.

To build with concrete, men make wooden or metal molds for the walls or foundations which they have planned. When the concrete is poured from the mixer into the molds, it gradually sets, or hardens. The molds are then removed. A concrete wall, especially if it has steel bars to reënforce and strengthen it, will last longer than a brick wall. It is about as strong as a stone wall.

Steel, the Strong Material

Now we come to a building material which is neither wood, nor brick, nor stone, nor concrete. This is steel. In the crowded cities, building lots are expensive. The builders in the cities, eager to build high so that many people can live over one building lot, could not depend on any of the old building materials. High buildings made of wood, brick, stone, or concrete might fall because of their own weight. With a steel framework high buildings can be erected with safety.

Steel, which is a form of iron, was once rare and expensive — too expensive to be used in building. For thousands of

years men used iron in tool-making. They obtained the iron for their tools from iron ore which they found in the earth. In iron ore the iron is mixed with rock and other impurities. The metal workers heated the ore in furnaces until the heat melted the ore and separated the liquid iron from the impurities. This process is called *smelting*. After smelting the iron, ironworkers formed the iron into the shapes of the tools they wanted. These iron tools were rather brittle; and the ironworkers were glad to learn that if they could use greater heat in smelting the iron ore, they could get rid of more of the impurities. Finally by using very great heat and mixing the liquid iron with other minerals, the metal workers learned to make steel, which is a much better material than iron for many tools.

But with the poor furnaces of long ago and with only wood for fuel, the metal workers were able to make very little good steel. Out in Asia, in the land of Arabia, there is a city called Damascus. This city became famous because of its steel makers, who made fine steel blades for springy swords and scimitars. In the time of Columbus, the soldiers of Europe prized these blades of Damascus.

So for a long time steel was used, but it was only for making costly swords and daggers. Steel remained scarce and costly until about seventy-five years ago, when men learned how to make it more cheaply. Steel makers built huge furnaces in which hot blasts from burning coal are forced through molten iron. In a few minutes these hot blasts can convert tons of liquid iron into steel.

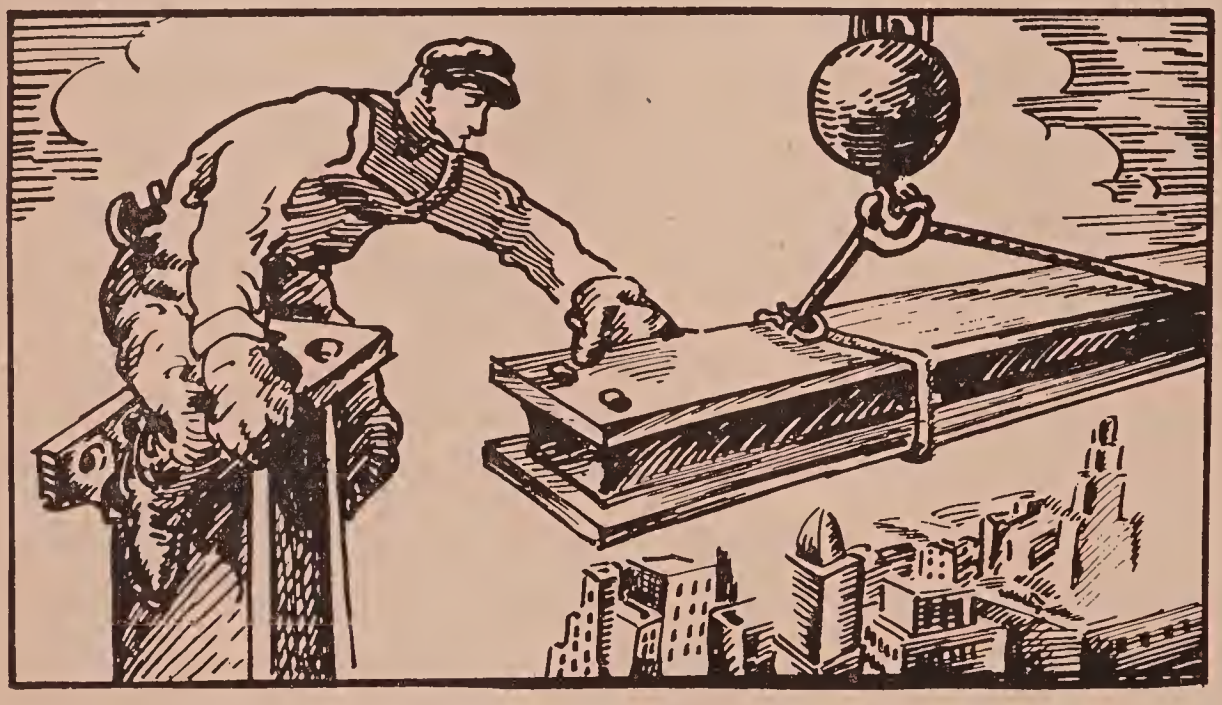
In this country some of the largest iron and steel mills are found in the city of Pittsburgh in the state of Pennsylvania, in the city of Birmingham in the state of Alabama, in Buffalo in the state of New York, in Chicago in the state of Illinois, in Cleveland in the state of Ohio. These cities are good places for steel mills because they are near enough to the iron mines from which they get their iron ore; they are also near enough to the coal mines from which they get coal for their furnaces. The iron ore is brought to the mills by water. Trains from the coal mines run right into the yards of the mill.

In a modern steel mill, there may be a long row of blast furnaces, each one making as much as eighty tons of steel at one heating. This liquid steel is run off into ladles, which pour it into molds. The molds shape the liquid into great red-hot lumps of steel called *billets*. One billet may weigh fifteen tons.

The billets are carried along to rolls in the rolling mill. The rolls look like the rolls of a clothes wringer. The red-hot billet is squeezed through a set of rolls, and then back again, perhaps twenty times. It is now much longer. On it goes to the next set of rolls, where the same squeezing and rolling takes place over and over again. A billet which went into the rolling mills seven feet long may have been rolled into an eighty-foot steel column or a hundred-foot beam, ready to be cut to any length in the cutting room.

Next, and last, these pieces of plain steel go to the bridge shops in just the right sizes for their use. Here the rivet

holes are punched. Everything that can be done before the steel framework is set, is done here. From the bridge shops, the columns and beams, of many different shapes and strengths, all marked and numbered, go directly to the building where they are to be used.



Setting a Steel Beam in Place

Steel Made the Skyscraper Possible

When men learned to make steel more cheaply in many shapes and sizes, steel that would not crack, nor shrink, nor wear out, the *skyscraper* became possible. So, about 1885, the first skyscraper appeared — ten stories high. Today, many of these first skyscrapers are being torn down and rebuilt to seventy and eighty stories.

When we speak of a skyscraper, we usually mean a building with its weight supported, not by its walls, but by a framework of steel hidden within the walls. This framework

is made up of upright steel columns for the outside walls, which are supported at each floor by beams and girders.

Beams are crosspieces of steel. A girder is a larger, heavier crosspiece which supports other beams.

The framework is held together by steel rivets or by welding.

A rivet looks like a thick blunt nail with a flat head. Each rivet is heated red-hot and placed in the rivet hole which was punched for it in the bridge shops. The rivet is driven through the beam to be riveted and the small end is hammered into a head so that it cannot come out. A rivet is stronger than a bolt because it is forced into the punch hole when red-hot and so fills every part of the space and becomes almost a part of the beam itself.

About 1926, men began to experiment with welding the framework instead of riveting. In welding, two pieces of metal are melted together by the heat from electricity.

Before a skyscraper can be started, all the steel must be ordered from the mills, in the right sizes and shapes. It must be stored near by, so that it can be brought in as it is needed, for there is no place in our large cities to store such supplies.

The one hundred and two stories of the Empire State Building in New York used more than 57,000 tons of steel. To prevent delay, the steel was ordered for two floors at a time two days before it was needed. The workmen had to be on schedule, so that they would be ready for each steel delivery when it came. About four floors of steel a week

were set. Five months after the building was started, the steel framework was in place to the fiftieth story.

This famous building used more than three hundred tons of a new kind of steel, called *chrome nickel steel,* for the outside trimming. This steel is tough and hard, yet it is easily workable. It will not rust. The Chrysler Building in New York has a cap of this bright steel.

If you could follow the building of a great skyscraper from day to day, you would see something like this:

As soon as the foundations are ready, truckloads of steel pieces arrive, in just the sizes needed, all numbered and ready. Uprights and beams are unloaded and placed near where they are to go. Bundles of beams weighing six or more tons are swung aloft by derricks or carried to their places by hoists like elevators. Later these hoists will carry the concrete, the bricks or stones, and the hollow tiles for the partitions.

When the steel workers have set the framework for the second story, riveters begin to rivet the framework of the story below. This is done with great skill. One man stands at the forge, heats the rivets and tosses them with a pair of tongs to the riveters. The riveters place the rivets in the punch holes, drive them in, and head them over.

As each story is set, it is inspected and the steel painted over with two coats to protect it from the air.

Pipes are now laid and wires put in place, through which water and electricity will be supplied later.

The concrete workers follow the riveters. They begin on

the story just riveted below them and lay the concrete ceiling of that story which is also the floor of the next.

When the steel window frames are put in place, the masons and bricklayers begin to wall in each story. The inside workers are now protected and can go to work. In a climate like that of New York, it is important that the work move along on schedule time so that the outside will be finished before winter begins. The windowpanes are put in last.

It is like a race; each kind of workman follows as soon as he can, and all try to reach the top in the time set.

When the famous Waldorf-Astoria Hotel in New York was torn down, samples of the old steel from different parts of the building were tested to see how much they had worn. In every case they were found to be practically as good as when they were set. This has been found to be true of other buildings. There seems to be no reason why the steel framework should not last several hundred years except that styles in buildings change and buildings are torn down long before their steel framework wears out.

Things to Do

1. Be very sure you understand the meanings of the words and phrases in the columns below.

quarry	furnaces	girder	kiln
explosion	billets	framework	welding
mortar	rivets	columns	inspected
concrete mixture	experiment	derrick	on schedule

2. In the sentences below write on the blank line the word or words which make the statement correct.

The largest iron and steel mills in America are found in _____, in _____, in _____, and in _____.

Skyscrapers are built of _____.

The tallest building in the world is in _____ _____.

It is _____ _____ stories high.

_____ _____ _____ tons of steel were used in building it.

Skyscrapers were first built in the _____ _____.

3. In the first column is the name of a material, in the second column the name of the country in which the material is found. Put the number before the country which you find in front of the product.

1. Carrara marble	Atlantic coast
2. granite	Pennsylvania
3. lumber	Italy
4. redwood	Northern New England
5. iron ore	California

Chapter 23

FURNISHING THE HOME

How many things it takes to furnish a home — beds and bureaus, tables and towels, rugs and rocking chairs, dishes and drinking cups, china closets and chests, pictures and plants. These are just a few of the many things which help to make our homes more comfortable.

The hunters who lived in caves may have had little furniture, but they did have pictures. The pictures were paintings of the wild animals which they hunted. They painted these pictures on the walls and ceilings of their caves.

The herdsman, living his nomad life, also had little furniture. He and his people slept on skins. They squatted on the earth or on woven mats.

Clay Pots, Chinaware, and Glass

When men long ago observed that clay was hardened by the heat from their fires, they shaped the soft clay into pots in which to store their grains. They hardened these clay pots by baking them in ovens which they built over their fires.

In the beginning, clay pots were shaped by hand. Then some one invented a potter's wheel, a stone set on an axle. Putting his clay on the stone, the potter turned the wheel;

and as the wheel turned, he used his hands to shape the clay into whatever form he chose to give it.

The Egyptians often painted pictures on pots. So did the Greeks. Some of their clay pots, jars, and vases that have been buried for thousands of years have been dug up in the ruins of old cities.

Today clay is used in making plates, saucers, and bowls. The finest of this ware is called *chinaware*, because hundreds of years ago only the Chinese knew how to make it. Now very good chinaware is made in our own country.

If we look at our china cups, we can see how smooth and shiny they appear. This shiny look is due to a glaze, or glassy substance, which covers the surface of the cup. A long time ago men learned the art of glazing pottery. The glaze which the early potters used may have helped men to learn how to make glass. Long ago the Phœnicians, who once lived on the shores of the Mediterranean Sea, not far from Egypt, learned to make glass. But it was not until about the time of Columbus that people learned how to make glass so clear that one could see through it.

For a long time transparent glass was so very expensive that most persons could not afford to buy it. But today glass factories make great quantities of glass, and it is not expensive. In glass factories sand and certain other minerals are heated together in a furnace. When this mixture melts, it becomes liquid glass; and as the liquid glass cools, it becomes sticky. Just here the work of the glass blower begins. He draws off some of the sticky glass into an iron

pipe. He then blows through the pipe, and as he blows, the warm glass expands like a soap bubble. He now can shape this glass bubble by placing it in a mold. As he continues to blow, the glass takes the shape of the mold.

In this way glass blowers can make jars, bottles, tumblers, and vases. But today machinery is used to do the blowing, and a single glassmaking machine, with machine blowers and machine molds, can shape thousands of electric light bulbs in a day.

Machinery is also used in making window glass. There is so much glass used for the windows in our buildings that we may well call glass one of the building materials.

Furniture Was Once Rare and Expensive

Before the days of Columbus, as you have just read, few people had any glassware, and they had no glass windows. In fact, up to the time of Columbus very few persons even had much wooden furniture, such as the chairs or tables or beds or bureaus or any of the other wooden furniture which we have today. The peasants, as the poorer farmers of Europe were called, sat on rough stools made by nailing a few boards together. Their tables were boards laid across wooden trestles. Their one most important piece of wooden furniture was the chest in which they stored their clothing, their food, and such few other things as they owned. When the colonists came to America, they brought these chests with them.

But about the time when America was being settled, the

rich people in Europe were thinking how they could make their homes more comfortable. They hired men to make them fine tables and better chairs, to put drawers in their chests. In these drawers the rich folk kept the linen tablecloths and the silver knives and forks which were coming into fashion. The furniture makers also made for the rich people great wooden beds, with four posts on which curtains were hung to keep out the cold winds.

When the European settlers in the country began to prosper, they also bought these new furnishings to make their homes more beautiful. For a long time only the rich colonists could afford these things; later the poorer people were able more and more to buy them.

Today in many large cities in this country there are factories in which men make furniture from lumber. With the machines in these factories helping to make wooden furniture more quickly, almost every one can have wooden beds, tables, chairs, bureaus, sideboards, bookcases, writing desks.

Our Furnishings Have Stories

Almost everything which we use to furnish our homes has a story.

There is the story of Oriental rugs which we buy from the people of Asia. In the olden days, the weavers in India, Persia, and China wove mats, or rugs, which the people used instead of chairs. In time they learned to design these rugs so beautifully and to color them so richly that today people all over the world use them to decorate their homes.

There is the story of knives, forks, and spoons — a story which begins with the hunters who used their fingers instead of forks.

There is the story of the stove. This story begins when men first built outdoor fires to warm them and cook their foods. It tells us of the time when men learned to build fires indoors in open fireplaces, with chimneys to carry off the smoke. It carries us to our own day when people use coal, oil, and gas in stoves or in furnaces. In large homes and in apartment houses today, pipes carry steam, hot water, or hot air from a furnace in the cellar to heat all the rooms in the house.

Another story is the story of the light in our homes. This story would tell how the people of long ago burned vegetable and animal oils in small lamps, and how our great-grandmother made candles from fats and vegetable oils. It would tell how, less than a hundred years ago, people learned to use kerosene oil and gas. It would tell how now in our own day many homes are lighted by electricity. Even the match has a long story.

The full story of all these things would take too long to tell. We will leave them to go on to the story of transportation, so that we can see how all the things which we have in our homes are brought to us from the places where they are made.

Things to Do

1. Make a list of the things needed to make our homes comfortable.

2. Make a list of the materials used to make these things.

3. Tell how man first invented dishes.

4. The invention of pottery is very important. Can you tell why it is so important? Read this chapter carefully and see if you can discover anything we do today which we could not have done had man not learned to make clay into dishes.

5. When you go on a camping trip, you take along the things you think you really must have to live comfortably. What are some of the house furnishings you take?

PART VI

BINDING THE WORLD: TRANSPORTATION—COMMUNICATION

CHAPTER

24. Carrying and Being Carried
25. Buying and Selling: The Story of Trade
26. Sending Messages: The Spoken Word, The Written Word, The Printed Word
27. Sending Messages: Telegraph, Cable, Telephone, Wireless, Radio

Chapter 24

CARRYING AND BEING CARRIED

All through the day and night, wagons, cars, automobiles, ships, and trains are carrying people and things. We need these ways of carrying and being carried. Ships and trains carry people and goods from the farms to the cities, from city to city. They carry goods and people from the cities to the farms. They also carry people and goods all over our country and from our country to other countries.

Man is not alone in his need of moving from place to place. Plants may get their food while rooted to one spot; but birds must fly, fish must swim, the animals of field and forest must roam about in search of food.

Transportation in Wilderness Days

In the days when all the world was a wilderness, men, like the animals of field and forest, had only their legs to carry them. The hunters returning with their loads carried their game on poles slung across their shoulders. To this day in many parts of the world people carry their burdens on their backs or on their heads.

After a time, man tamed the horse and used it to carry him and his packs on long journeys. Camels carried traders and their goods across the deserts in Africa and Asia. The

llama carried goods across the mountains of Peru in South America. The camel, the llama, and the horse are still used as beasts of burden.

Long after man learned to use animals for carrying; some one, it may have been a herdsman in Asia, invented the wheel and the wheeled wagon. Wheels were a great help in carrying. Wagons could hold heavy loads, and with axles to help the wheels turn, horses or oxen could draw greater loads than they could carry on their backs.

But even with wagons and animals to help, traveling and carrying goods by land was not easy. It took time to clear roads. When heavy rains made the roads muddy, it was almost impossible to move from place to place.

Long before the wheel and the wagon were invented, some people saw that, if they could travel by water, they could move about more rapidly than they could through thick forests. Hunters and herdsmen may have crossed streams or even floated down streams on logs. They may have noticed that a log pointed at one end moves through the water more easily. Then some one may have seen that, if a log were hollowed out, it could carry things, and there would be less danger of tipping over. Poles could be used as paddles or oars to help in moving the log through the water. In some such way, step by step, men learned to use boats for moving from place to place.

In our story of man's conquest of the wilderness we read how the Egyptians learned to put sails on their boats, and how, with the wind to help them, they sailed up and down

the Nile River. Sailboats carried the knowledge of farming along the Mediterranean Sea to the countries of Europe. Guided by compasses, sailboats from Europe crossed the Atlantic Ocean and found America. Other sailboats brought many people from Europe to live in America.

The Steamboat Is Invented

Until one hundred years ago men used oars or the power of wind to make their boats move. Then people learned how to use the power of steam instead of oars and wind.

Some one in England had made a steam engine. In this engine, the burning of wood and coal caused water to boil, and the force of the steam from the boiling water was used to work a pump, which pumped water out of coal mines.

Soon men began to plan other ways of using the power of steam.

One man, Robert Fulton by name, decided to use the force of steam to turn paddle wheels on the sides of a boat.

In the year 1807, his boat was ready. He called it the *Clermont*. Many people called it "Fulton's Folly."

Fulton tested his boat on the Hudson River. When the engine started, the steam-driven paddles turned in the water, and the boat moved upstream against the current at five miles an hour. Steam was taking the place of wind and oars.

The first steamboats ran on rivers. But soon steamboats were running on lakes and seas and on the ocean as well. Today sailboats are still used, but most of the large boats on the rivers and lakes and oceans are steamboats. On most

of our steamboats the steam engine no longer turns side wheels. Instead, there is a powerful propeller on the rear of the boat. The engine turns the propeller, and then, as the propeller revolves, it drives the boat forward.

Some of the ocean steamboats are like huge apartment houses. They have room for hundreds of people, who live on the boats for days and weeks. One of these boats has dining rooms, sleeping rooms, a music room, tennis courts, a gymnasium, a swimming pool, a barber shop, a children's toy and game room. Ocean steamships carry thousands of tons of goods besides the passengers.

There are many steamboats which carry people and goods across the Atlantic Ocean to Europe. Some of these boats go through the Straits of Gibraltar into the Mediterranean Sea, past Italy and Greece and Turkey to Egypt.

There are steamboats which go down the Atlantic coast of the United States to Cuba and the other islands near Cuba. Some sail farther south to the countries of South America. Some go into the Pacific Ocean by way of the Panama Canal, which engineers have cut through the narrow piece of land which connects North and South America. In this way these steamboats can more quickly reach the Pacific coast countries of North and South America.

Many steamships go from the Pacific coast cities to Japan, China, India, and Australia.

The Steam Locomotive

Until the time of the steamboat, carrying by land remained the same as it had been since the days of the first pack animals and the first wagons drawn by animals. But now, seeing how an engine could turn the wheels of a boat on water, men built steam engines to turn the wheels of wagons on land, and they laid rails on the roads, so that the wheels would turn more easily. The front wagon, which carried the steam engine, was called a steam locomotive. This locomotive pulled a long train of carriages or cars. The road of rails was called a railroad.

In this country about the year 1830 a railroad was built from Baltimore to a village twelve miles away. Soon many more miles of railroad were built.

On these early railroads little steam locomotives pulled a few curious-looking carriages. The engines used wood for fuel. The sparks from the engines flew back over the passengers. The carriages were poorly heated by small wooden stoves and lighted with oil lamps. The rate of travel was about twelve miles an hour. Some of you may have seen one of these old trains in the balcony of the Grand Central Station at New York City.

Today a steam locomotive is a huge and beautiful machine weighing many tons. It burns coal or oil. It can pull ten or fifteen passenger cars at high speed and many more freight cars loaded with goods. Some of the freight cars, called *refrigerator cars*, have ice to keep cool and fresh the

fruits or meat which they carry. Some are heated to keep vegetables from the south from freezing on their way north.

Some of the passenger trains, called *Pullmans*, have sleeping berths. The trains also have dining cars. Almost all trains today are well heated and are lighted by electricity.

Railroads and steamboats have helped carry men into the West to tame the American wilderness. They have bound the whole country into one. They carry the farmers' crops to the city. They carry manufactured goods from the cities to the farms.

New Ways of Carrying and Being Carried

As the railroads and steamships carried people into the country, the number of farms increased, but at the same time the cities kept on growing. The people in the cities had to go miles and miles to get to their work. A way was found to carry them. Some men learned how to use electric current to turn the wheels of electric cars. These electric cars, running along tracks in the city streets, carried men and women to their work. The electric power which turns the wheels of the cars comes through wires or rails from the electric power house.

About forty years ago some people found a way of making a car which would not need tracks. They invented small gasoline motors which would make their own power. They put these motors into their cars, and so automobiles were born. Today one man out of every five in this country owns an automobile. Automobiles and automobile trucks are a

great help to the farmer. They help carry his goods to the railroad station or to the near-by town. They help him bring home the things which he buys in the city. Automobiles are now so common that it is perhaps hard for you to realize that they were just beginning to be seen on the streets when your parents were children.

Forging a Steel Axle for an Automobile

The latest way of carrying things is by airplane or by dirigible. The sea is a good road. The land road is good. But it seems that the great new road is the air. With a gasoline motor in his airplane or dirigible, man can ride anywhere.

Our airships are not perfect yet. The first successful flights in the air were made about twenty years ago. By 1924 airplanes flew around the world, as you read in the first chapter. In that same year a dirigible came from Germany across the Atlantic Ocean to the United States. Air-

ports and landing fields are being built in many parts of the world. Our own country has nearly two thousand, and nearly eight hundred more are planned. Today there is air travel by day and by night. For night travel flying fields have to be well lighted. There are airports along both the Atlantic and Pacific coasts, for flying between ocean liners and the shore. At Oakland, California, there is an airport bringing together rail and air lines across the continent, and ship lines across the ocean. Planes that can take off from land or water have direct contact with steamships.

You have all heard of Colonel Lindbergh's famous flight across the Atlantic Ocean, how he flew alone in his plane which he called *The Spirit of St. Louis*. His plane was named for the city of St. Louis, which is in the state of Missouri. In St. Louis, there is a flying field where much flying is done both for pleasure and as a means of travel. During June and July, 1930, it is said that 14,300 passengers left Lambert Field, the St. Louis flying field, and 15,000 passengers arrived.

At the Grand Central Terminal Airport in Los Angeles, California, during the first six months of 1930, 25,608 passengers landed in Los Angeles. During the busiest day 253 airplane passengers arrived in this city.

Airports are now scattered over every state in the United States. California leads with 154; Texas has 101; Pennsylvania, 85; Ohio, 76; Iowa, 45; Michigan, 44; Florida, 41; Virginia, 32; Massachusetts, 23; Connecticut, 10.

Some of these are for purposes of carrying passengers and

goods. But there are many airports owned and operated by the governments of the states and the United States, for purposes of carrying messages and transacting important business for the Army and Navy, and for other departments of the government.

All over the world this new way of traveling is fast being made safe. England, France, Germany, and Italy had well-developed commercial flying before Lindbergh's flight to France created a new interest in air travel in America.

When airships become safer and can carry larger loads, they may take the place of ships and railroads. Even now United States mail is carried by airplanes from the Atlantic coast to the Pacific coast.

The Story Briefly Retold

Now, if we look back at our story of transportation, we see that until about one hundred years ago men were using wagons and animals on land, sailships on the water. They could not carry things in the air. Suddenly there came the steam engine, the electric engine, and the gasoline motor, which made travel on sea and land swifter. Then the gasoline motor opened up traveling by air.

With the coming of the railroad, hundreds of thousands of miles of good steel track have been laid across the lands of the earth. With the coming of the steamship, traders have been able to set up trading posts in almost every corner of the world. With the coming of the automobile, men have built hundreds of thousands of miles of good highroads,

binding the farms and cities of our land. With the coming of the airplane, airports and landing fields are rapidly increasing, making distances shorter, because flying is the fastest method of travel.

With all these aids to travel and to the carrying of goods, the whole world has been brought near to us. Any one who saves enough can travel around the world. Any one who does his share of the world's work can earn enough to buy food and clothes and things for his home which have been brought to him from the four corners of the earth.

Things to Do

1. Draw a series of pictures showing man's ways of traveling on land.
2. Draw a series of pictures showing man's ways of traveling on the water.
3. If you cannot draw well enough to make these pictures, you would find collecting them from old magazines very interesting. Mount them and place them around your classroom to help you in your study of this chapter.
4. Write a short story of the invention of the first steamboat, telling who invented it, when, its name, and an account of its first journey.
5. On your outline map of the world trace the route traveled by a ship going from New York City to England; from New York City to Italy; from Italy to Egypt. Trace the route traveled by a ship going from New York City to the western coast of South America.
6. Find out how long it would take to make any of the trips you have traced on your map. Travel folders published by steamship companies will help you with this lesson.

7. On your outline map of the world locate the Atlantic Ocean; the Pacific Ocean; the Straits of Gibraltar; the Mediterranean Sea; the Panama Canal.

8. Write a short story of the earliest locomotives.

9. Write a short story of the airplane.

10. On your outline map make a dot or a star with your blue pencil showing the locations of the largest airports in the United States.

Chapter 25

BUYING AND SELLING: THE STORY OF TRADE

We have just read how the ships and trains of our country are carrying goods from the farms to the cities and from the cities to the farms. We have read how ships and trains are helping to carry goods from one country to another. Most of these ships and trains are carrying goods from people who wish to sell to people who wish to buy. The buying and selling of goods is called *trade*.

Buying and Selling Today

The farmers who produce more food than they need for themselves sell the remainder to the cities. The city people who produce more clothes and tools than they need, sell the remainder to the farmers. But, as a rule, the farmer does not sell his wheat directly to the people living in the city. The farmer and the city dweller buy the things they need from stores where the storekeepers have laid in a stock of goods for them to buy.

How does the farmer get the money with which he buys from the stores? When the farmer sells the crops from his fields, the animals from his barn, milk, butter, chickens, eggs, or cheese to the cities, he receives money in return. In

the same way, when the city people sell the farmer goods made in their factories, they receive money in return. All people receive money for their work, and then they use this money to help them in their trading.

In all this buying and selling, ships, trains, wagons, and automobiles are carrying money and goods back and forth between the farms and the cities. Ships and trains carry money and goods from all over the world to the large cities and to the storekeepers, who make their living by buying and selling.

Today the farmer in the country buys the city goods from the country store, which has a stock of almost anything from a pin to a phonograph. When he reads the advertisements in the newspapers or magazines about goods sold in the city stores, he sometimes buys these things by mail. He sends his letter and money to the city store, and the city store sends him the goods by parcel post.

Many farmers have mail-order catalogs in their homes. This catalog has a list of things which a mail-order store in the city has to sell. The catalog also has pictures of these things and the prices of each. If the farmer and his wife need any of these things, they send their order and money to the mail-order store in the big city. The mail-order store sends them what they order.

The people who live in the cities buy from many different kinds of stores. They may buy hats from a hat store, food from the grocery and the meat market, furniture from a furniture store; or they may buy the different things they

need from a department store, which is like a country store, except that it is much larger.

A city department store sells almost everything. In the department store there is a grocery department, a meat department, a furniture department, a clothing department, a toy department, and many more departments, each of which may be as large as the smaller stores scattered through the city.

Many of the stores do not buy the things they sell directly from the farmers or the factories. They buy from other stores, called *wholesale stores*, which buy very large quantities of goods at a time. A small grocery store may buy ten hundred pounds of sugar from a wholesale sugar merchant, who keeps great quantities of sugar in his wholesale store. The wholesale dealer buys the sugar from a sugar refinery. The sugar refinery buys its raw sugar from sugar plantations. This is how people trade today, but people did not always trade in this way.

Trading in the Older Days

Trade has a story, just as transportation has a story. This is the story of trade.

The early hunters had little need for trade. They hunted for their own food and clothes.

When some men became herdsmen and others became farmers, and still others lived in towns and cities, people had to trade.

Some hunters may have wanted wool from the herdsmen.

Some herdsmen may have wanted furs from the hunters. When the herdsmen did not have enough wild grain, they wanted the good grain raised by the farmers. The farmers who raised more grain than they needed, wanted clothes woven by weavers in the towns and cities.

In the beginning, when the people wanted things from one another, they often tried to get them by force. The armed hunters tried to steal from the herdsmen. Fighting herdsmen came into the farming countries to steal grain from the farmers who had stored it up in barns. The sailors who sailed from the cities in the farming countries set out in ships to rob the people of other countries.

People fought to defend their goods against the robbers, and in the battles many lost their lives, but in time some people learned that it is better to exchange goods peacefully than for both sides to kill each other.

Trading by Exchange of Goods

These wiser ones took to trading. The first trading was done by exchanging goods. Somewhere between the forest homes of the hunters and the pastures of the herdsmen, men would meet to exchange furs for wool. Somewhere between the pasture lands of the herdsmen and the tilled fields of the farmers, men would meet to exchange wool for grain. In Egypt the farmers came to the towns to exchange part of their grain for the things made by the workers in the cities.

In the earliest days of trade exchanging goods was not always easy.

Let us imagine an Egyptian farmer who comes to town with ten bushels of grain, in exchange for which he wants one new pot. He finds the potter displaying his wares on the street in front of his shop. The potter has all the grain he needs. How can they exchange?

"Take my fine grain," says the farmer, "and give me that stupid pot."

Says the potter, "I do not need poor grain; I need some good bricks to repair my kiln."

The farmer answers: "Give me the pot. A bricklayer will give you bricks for my grain."

This is good advice, the potter agrees, but it turns out that the bricklayer has all the grain he needs. He wants some good linen, and he will not take grain for his bricks. What is the potter to do?

The potter has to find a linen weaver who needs grain. He exchanges the grain which he does not need for some linen which he does not need; then he exchanges the linen which he does not need for the bricks which he does need; and so the farmer, the potter, the brickmaker, and the linen weaver all exchange what they own for what they need.

Gold Provided a Useful Means of Exchange

This kind of trading by exchange was a roundabout business.

After a time people in Egypt found an easier way. They used gold in their trading. Gold was something which people were always glad to receive in exchange for anything. This

rare metal, found in the mountains, took up little room; it did not spoil, it could be hidden away easily. Besides, the jewelers were always wanting gold for the ornaments which they were making for the ruler, or Pharaoh, and the nobles of Egypt.

With gold to help in trading, some men now spent their lives in trading. These traders did not make things. They bought from those who wanted to sell. They sold to those who wanted to buy. In their buying and selling, they used gold.

There was one trouble with gold. A dishonest trader might cheat. He might mix poor metal with good gold. To make sure that they were getting good gold, the traders had to weigh the gold and test it in every exchange they made.

The constant weighing and testing of the gold was a bother, but for a long time men could think of no better way. Then a king named Crœsus, who ruled in a land near Egypt, had gold melted down and made into coins, which he stamped with his seal. Each coin weighed just so much and was just so pure. When a trader took a gold coin in trade, he did not have to weigh and test it. The king's seal was enough. From that day on, gold, silver, copper, and other metals have been made into coins which help people in the cities in their buying and selling.

In the country gold and silver were scarce; so much of the trading still had to be done through exchange. When the white people came to this country, they found some of

the Indians using beads for coins. The beads were made of shells. For a long time the newcomers in our country had very few gold or silver or copper coins. In their trading they used wampum beads, as the Indians did, or they used tobacco and furs for money. Often they exchanged goods, very much as the Egyptian potter and the brickmaker exchanged goods. The farmer paid the furniture maker with corn. The furniture maker who received more corn than he needed, exchanged some of his corn with a fisherman who caught more fish than he needed.

But here, as in Egypt, people found it hard to buy and sell without metal coins to help. So, when the people set up their own government, the United States of America, the government made gold, silver, and copper coins, and stamped them with the government seal.

Still, gold was scarce in this country until the year 1849, about the time of our great-grandfathers. At that time men found gold in the bed of a river in California. Others found gold near by. At once there was a great rush of people to the 'gold fields.' Later, gold was found in other parts of the West and in Alaska, too. Some of this gold was gathered up with the river soil and held in a sieve in the running water. The water carried off the earth and left the heavy particles of gold. Today gold is obtained from the mountains by mining.

All this gold helped trade. With gold, men paid workers to build more of the new steamboats and railroads and factories. With gold, men paid for new tools which helped the

factories make things more quickly. Many men put their gold together to form wholesale trading companies. Some of these trading companies were soon carrying on trade with all parts of the United States. There are trading companies which carry on trade with all parts of the world.

To help in all the trade which is going on, there are banks where people can deposit their money. These banks lend some of the money to farmers, to factory owners, and to merchants.

The farmers use the money which they borrow to help them raise the crops which they sell. Then they pay the money back to the banks.

Factory owners use money which they borrow to help them buy raw material, and with it they pay wages to their workers. When they have sold their goods, they pay back to the bank what they have borrowed.

Merchants often borrow money from banks, so that they can buy goods from the farmers or from factory owners. When the merchants have sold the goods, they pay off their bank loan.

People who deposit their money in business banks pay for the goods they buy by check. The check is a paper which tells how much money the depositor wants the bank to pay out. It also tells to whom the money is to be paid.

Today if we wish to travel anywhere in the world, we do not have to carry all our money with us. We can leave it in our bank at home. The bank arranges that we can get our money in any country which we visit.

The banks also arrange for payments made by companies in our land to farmers, factory owners, or merchants in other lands.

So today the whole world is like one market place in which men are buying and selling. By this buying and selling, the wares of all the lands are brought to our doors.

Questions to Answer

1. How did people carry on trade in ancient times?
2. Who invented the first coin, or piece of money?
3. Why was this invention important?
4. What did the American Indian give the white people in exchange for tobacco and furs?
5. How is buying and selling carried on today?
6. When we travel to a foreign country, do we have to take money with us?
7. What better way can be arranged for us than to carry money? How do we do this?

Chapter 26

SENDING MESSAGES: THE SPOKEN WORD, THE WRITTEN WORD, THE PRINTED WORD

It is evening. Mother is reading her newspaper. Father is reading a business letter. John is calling his sister to show her a picture in his book.

The words which John is speaking, the writing which father is reading, the printing which mother is reading, all are ways of carrying messages.

John's spoken words carry a message from his mind to the mind of his sister who hears them. The written words in the letter carry a message from the mind of the man who wrote them to the mind of John's father. The printed words in the newspaper carry a message to John's mother.

We need ways of sending messages, so that people can work together to get food, clothes, and shelter.

People need to talk to one another about their work. They must write to one another about business. They have to learn about the world from books, magazines, and newspapers.

Within the last hundred years, men have invented new ways of sending messages: the telegraph, the telephone, the cable, the wireless, radios, and motion pictures. In the next chapter we shall describe these new ways of sending

messages. In this chapter we shall read how the spoken word, the written word, the printed word, came to be.

The Spoken Word

The story of the sending of messages begins when all the world was still a wilderness and people were first learning to put their thoughts into words. As people discovered the power of speech, those who lived in different countries invented names for the things around them. Thus people who lived in one valley would call a tree by a different name than those who lived in the next valley. In this way it happened that each land had its own language, and each language was like a code which could be understood only by those who had learned it.

The different languages which people invented have come down to us, with new words which have been added from time to time. Today people are still adding new words to the languages which they speak.

Almost all the people in our country speak English. In England the people also speak English, but their way of speaking it is a little different from our way. Even within our own country people in different parts of the land speak in somewhat different ways.

In most of the lands which lie south of the United States, people speak Spanish. Most of the people in Canada speak English, but in some parts of Canada people speak French. The English language was brought to this country and to Canada from England. The French language was brought

to Canada from France. The Spanish language was brought from Spain to Mexico and to the many countries south of Mexico, although in some South American countries the Portuguese language is spoken.

For a long time after people learned to speak, they did not know how to write; but then some people who wanted to send messages drew pictures on wood or on animal skins, and these pictures carried their thoughts to others. The Indians in this country still use picture language for writing, and they can read a letter drawn with picture signs.

The Written Word

In time the people in some countries learned to use an alphabet for writing. They invented a code of signs to stand for different sounds like A, B, and C, and with these signs they spelled out words. So the art of writing was born. Any one who learned the signs of the alphabet had a code with which he could spell words and send letters in writing. Some men now wrote their messages with brushes on animal skins or on a paper made from the stalks of plants.

Sending messages by writing helped people. Before writing was invented, people could teach only by the spoken word, which might be poorly remembered or even forgotten. When people could write books about the things they did and about the things they learned, their books preserved their thoughts exactly as they wrote them down. In this way knowledge was carried to all persons who could read.

For thousands of years books were written by hand, and

all copies of books were made by hand. For this reason books were expensive. Few people could afford to buy them. Few people knew how to read.

The Printed Word

About five hundred years ago, about the time when Columbus was born, some men learned how to make copies of books by printing them. They cut letters out of wood. They put these letters together to form words and sentences until they had a whole page. They used a printing press to print many copies of this page from the one page. In this way they were able to print many hundreds of books in less time than it would have taken to write out one copy by hand. They printed their books on paper made from linen fiber. You will learn more about books in Chapter 30.

One thing which helps in the printing of our millions of books, magazines, and newspapers is the way in which paper is made today. Until a short time ago most paper was made by hand from rags. Today paper is made in paper mills from logs.

Near the paper mills there are great piles of logs which have been floated down from the forests. In the mills, machines grind these logs into small chips. Tons of these chips are poured into metal tanks, containing powerful acids. Trees, like many other plants, have fine fibers running through them. As the acids break up the woody fibers in the chips, the fibers change to a soft, wet mush, called *pulp*.

To see what pulp is like, we can tear a piece of paper into

shreds, soak the shreds in water, then squeeze them into a small mass.

When the pulp has been made very fine by other machines in the mill, it enters the paper-making machines. It flows on to this machine, mixed with water, one hundred parts of water to one part of pulp. As this liquid mixture flows along a sort of metal apron through which many holes are punched, the water drains off, and the wood fibers in the pulp join to form a long sheet of paper about six feet broad. As this sheet moves on, it is dried by heat. At the far end of the machine, the paper is wound up in rolls. There are five miles of paper to a roll.

We need this quick way of making paper for the printing presses of today, because our huge newspaper presses can print as many as one thousand newspapers a minute.

The men who set up the type for newspapers are helped by a machine called the *linotype* machine. As they type on this machine, metal letters fall into place. Each line of these metal letters then drops into a pool of liquid metal, where a mold of the line is made.

Carrying Words by Mail

Before the day of the steamship and the railroad, letters, books, newspapers, and magazines could carry their messages only as fast as sailing ships, horses, or carriages drawn by horses could take them. In this country the government established the Post Office, to send mail from one part of the country to another, but in the early days it took days

for a letter or newspaper from New York to reach Boston. It took weeks for mail to be carried from New York to Chicago. It took months for mail to cross the continent. The cost was so great that little mail was sent.

Today trains running from the Atlantic coast of our country carry mail across the continent in four days. The cost of sending a letter this distance is two cents. With steamships to help, the United States mail carries letters halfway around the world for two cents.

In our schools, boys and girls learn how to use spoken words. They learn how to spell and to write. They learn how to read. Being able to speak well, to write well, and to read well, not only will help them to do their share of the world's work, but will help them to learn about the work done in all parts of the world.

Things to Do

1. All the words in the list below have to do with communication. First, be very sure that you know what *communication* means, then tell in what way these words have to do with communication. If you can do this, you have learned a great deal from this chapter.

telegraph	code	letters	newspapers
telephone	reading	books	paper
wireless telegraphy	radio-telephony	pictures	telegram
radio	messages	spelling	conversation
cable	language	magazines	writing

2. Find how many boys and girls in your class have had experience with different ways of communicating.

Chapter 27

SENDING MESSAGES: TELEGRAPH, CABLE, TELEPHONE, WIRELESS, RADIO

Howard, who lives in the country, is not helping his father today. Early this morning he went down the road to watch linemen fasten telegraph wires to wooden crossbars on an old tree. Howard's father gave the men permission to cut branches from the tree and to put up the wires which will run from the great city to the near-by village.

Howard's father knows that the telegraph helps to bind the farms and villages, the towns and cities, in our broad land into one united nation.

It is less than one hundred years since a few men began to see that the people in our country who were living thousands of miles apart needed swift and sure ways of sending messages through space. These men began to experiment with new ways of sending messages, and it was out of their experiments that the telegraph, the telephone, and the cable were born.

Old Methods of Signaling

Long ago, people used columns of smoke from hilltop fires, or the beating of drums, as signals to friends who were far away. Some wilderness peoples still use these means of signaling. But for the million and one messages which the

people in our country had to send, they needed the new inventions.

Mr. Morse and the Telegraph

While still in college, one American, Samuel F. B. Morse, learned of the experiments which men were making with electricity. Years later he formed the idea that the electric current passing through wires could be used to carry messages from a sending instrument to a receiving instrument. By pressing a button in the sending instrument, the electric current, passing through the wire, would make a mark or cause a click in the receiving instrument. He made up a code in which a short stroke would stand for a dot, and a longer stroke would stand for a dash. A dot and a dash would stand for A; a dash and three dots would be B, and so on all through the alphabet.

In the year 1844, with money voted by Congress, Mr. Morse built a line of wires. His plan was tested and proved successful. The first message to be carried in this way was "What Hath God Wrought."

This way of sending messages is called the *telegraph*, a word which means "write at the end." Today there are millions of miles of telegraph wires carrying messages over the lands of the earth. Before the telegraph, it often took weeks and even months for people in the eastern part of our country to know what was happening in the west. The telegraph now carries messages almost within the minute.

Mr. Field and the Ocean Cable

Telegraph wires, bound in heavy cables, also carry messages under the oceans. In the year 1858, through the work of Cyrus Field, the first successful cable was laid across the Atlantic. Mr. Field felt that we should have such a cable, and that it would work. He persuaded people to give money for laying it. Twice cables had been laid as he suggested, and twice they had failed, but the third time the cable worked. Farmers, merchants, bankers, factory owners, government officers in this country were able to send messages to Europe and to receive them.

Today there are eight Atlantic cables from the United States to Europe. There are cables from the United States to Asia. There is a cable from the United States, down under the Atlantic, to South America. In South America this cable continues from the Atlantic Ocean across the continent to the Pacific Ocean. To reach the Pacific, the cable had to be carried across the high Andes Mountains.

Mr. Bell and the Telephone

The telegraph and the cable transmit written messages. Other inventors found ways of carrying the sound of the voice through space.

In the year 1876 Alexander Graham Bell showed people in the city of Philadelphia an instrument by means of which people could speak through space. It was the telephone. In the telegraph the electric current in wires carried the

message in code. The telephone wires carry the message of the voice itself.

Today in our country and in many other lands, people have telephones in their homes and in their offices. They use the telephone again and again throughout the day to speak to people in their own towns or in distant towns and cities.

Throughout each day millions of business messages are being sent in this way by means of the telephone.

The Wireless and the Radio

Only a short while ago inventors found a way of sending messages without the aid of wires. Men now flash wireless code messages across land and water. Wireless has been especially useful to ships at sea.

The latest invention for sending messages is the radio, which is a wireless way of carrying the voice through space. This is called *radio-telephony*.

Something about Distances and Costs

Distance makes little difference in telephone calls among the countries of the world. The distance a voice travels between New York and London is about 3600 miles. From San Francisco to Oslo, Norway, the voice passes one-third of the way around the world in less than a quarter of a second. A call between Mexico City and Madrid in Spain follows a path of more than 7700 miles.

The United States has telephone connections with 29 countries. Great Britain can talk with 37 countries and

France with 36. The number is growing so rapidly that within a very short time these facts will be out of date.

You may like to know how much it costs to talk to some one across the Atlantic Ocean. When men first began to talk across the ocean by means of a telephone without wires, a call between London and New York cost $75 for the first three minutes, with $25 for each additional minute. These rates have been steadily reduced until in May, 1930, the rates were $30 for the first three minutes and $10 for each additional minute.

Not only can persons talk between two cities, but it is possible for a person on board a moving steamer to talk with some one on shore. Conversations are carried on daily between passengers on the great ocean liners, the *Leviathan*, the *Majestic*, the *Olympic*, and their relatives and friends at home. Like all long-distance telephoning, the cost of these ship-to-shore conversations varies with distance.

There is also under way a project for a radio-telephone station on the Pacific coast near San Francisco, through which telephone service will reach to the Hawaiian Islands and westward to Australia and the countries of the Far East.

Many other countries of the world are extending their radio-telephone service thousands and thousands of miles from their homes.

Something to Do

If you have read this chapter carefully, you will be able to write on the blank lines in the following sentences the word or words which make these statements correct.

1. The telegraph is a method of sending a message over a wire by _____.

2. The telegraph was invented by _____ _____ in the year _____.

3. Messages can be carried on the ocean by _____. The first _____ was laid across the _____ _____, through the work of _____ _____ in the year _____.

4. The telephone is an instrument through which two persons can _____.

5. _____ _____ invented the first telephone in the year _____.

6. The United States has telephone connections with _____ _____ countries.

7. Talking to some one across the ocean by telephone without wires is called _____ _____.

8. The distance a voice travels between New York and London is about _____ miles.

PART VII

TOOLS THAT HELP IN THE WORLD'S WORK

CHAPTER

28. How Man Uses Tools to Increase His Power
29. Copper, Iron, Steel, Coal, and Oil Make Tools Possible
30. Books as Tools

Chapter 28

HOW MAN USES TOOLS TO INCREASE HIS POWER

When workers are busy putting up a steel building in the city, many people stop to watch them and the giant tools which they use. Here a great steel beam, weighing tons, is being lifted hundreds of feet. Two men are on the beam, but they have no fear. They know that the man at the engine has pulled the lever which started wheels going; those wheels are pulling a cable which runs around a pulley above them, down to the beam which they are riding. They know that the engine, the wheel, the pulley, and the cable have all been tested. They have faith in these tools which are helping them in their work.

Wherever we look, in our homes, on farms, on country roads, in city streets, in factories, stores, and offices, we see people using tools to help them.

In our story of the taming of the wilderness, we read about some of the ways in which tools help man. Without tools the wilderness people could never have defended themselves against fierce animals. Without tools men could never have turned the wilderness into towns and cities. Tools helped men by increasing their power many times over.

When the hunters found that their hands were not strong enough to kill their enemies, they made themselves wooden

clubs. Clubs gave a longer reach to men's arms. They gave more force to men's blows.

When men threw stones, the reach of their arms increased. When they used bows to throw arrows, the reach and force of their arms increased still more. Later they learned to use guns and cannon to hurl shot at their enemies. Today a cannon can throw a cannon ball many miles.

Just as men made tools to do what their arms could not do in throwing, they made tools to do what their legs could not do in walking. They made tools to do what their backs could not do in carrying. They made tools to do what their hands could not do in plowing the earth, in gathering the harvest, in grinding grain, in sowing, in cutting down trees, in sawing trees into lumber, and in many other tasks.

Women also had tools, such as needles, which helped them in sewing. They had spindles and looms to do what their unaided hands could not do in spinning and weaving.

In the early days when men were hunters and herdsmen, they made their simple tools of wood, stone, or bone. Later men learned to make tools of copper, bronze, iron, and steel.

With metal, men made axes and saws to cut down the forests. With wood cut from the forests, men made wheels which helped them carry their goods; they made ships to be rowed by oars or driven by the wind.

We have read how ships brought people from Europe to America. The same ships also brought to America many of the tools which these people had been using in Europe.

With these tools to help them, the white people prospered

in America. By the year 1776 the people in our country were strong enough to declare themselves free from the rule of a king in Europe. So the United States of America, a new nation, was born to take its place among the nations of the world.

In 1776 our nation was new, but most of the tools which men used at that time were old. They were like the hand tools which the men and women of Europe had been using for thousands of years.

The Steam Engine

But about this very time the world suddenly made a great leap forward in the invention of tools. Many of the new tools were invented in America, but much of the progress in tool-making began in the year 1769, when James Watt in England invented the steam engine.

Before the time of the steam engine, people had found ways of using the power of animals, of fire, of wind, and of falling water to help them with their tools. The steam engine used the power of steam to help man in his work.

When the water in our teakettles is heated, it changes to steam. As the steam needs more room than water, it comes out through the spout. If we seal the spout, the force of the steam will explode the kettle. Steam seeking escape from a closed chamber has much force. In the first successful steam engine, you may remember, the force of the escaping steam was used to work a pump which pumped water out of a coal mine.

Soon other men used the steam engine to turn the wheels of the new spinning machines and the new looms. They used steam power to turn the wheels of the new sewing machines. Steam engines turned the paddle wheels or the propellers on ships. Steam engines turned the wheels of railroad locomotives.

The city factories, working with steam engines, could make things more quickly than people working at home with hand tools; so more and more work was done in factories, and the cities grew.

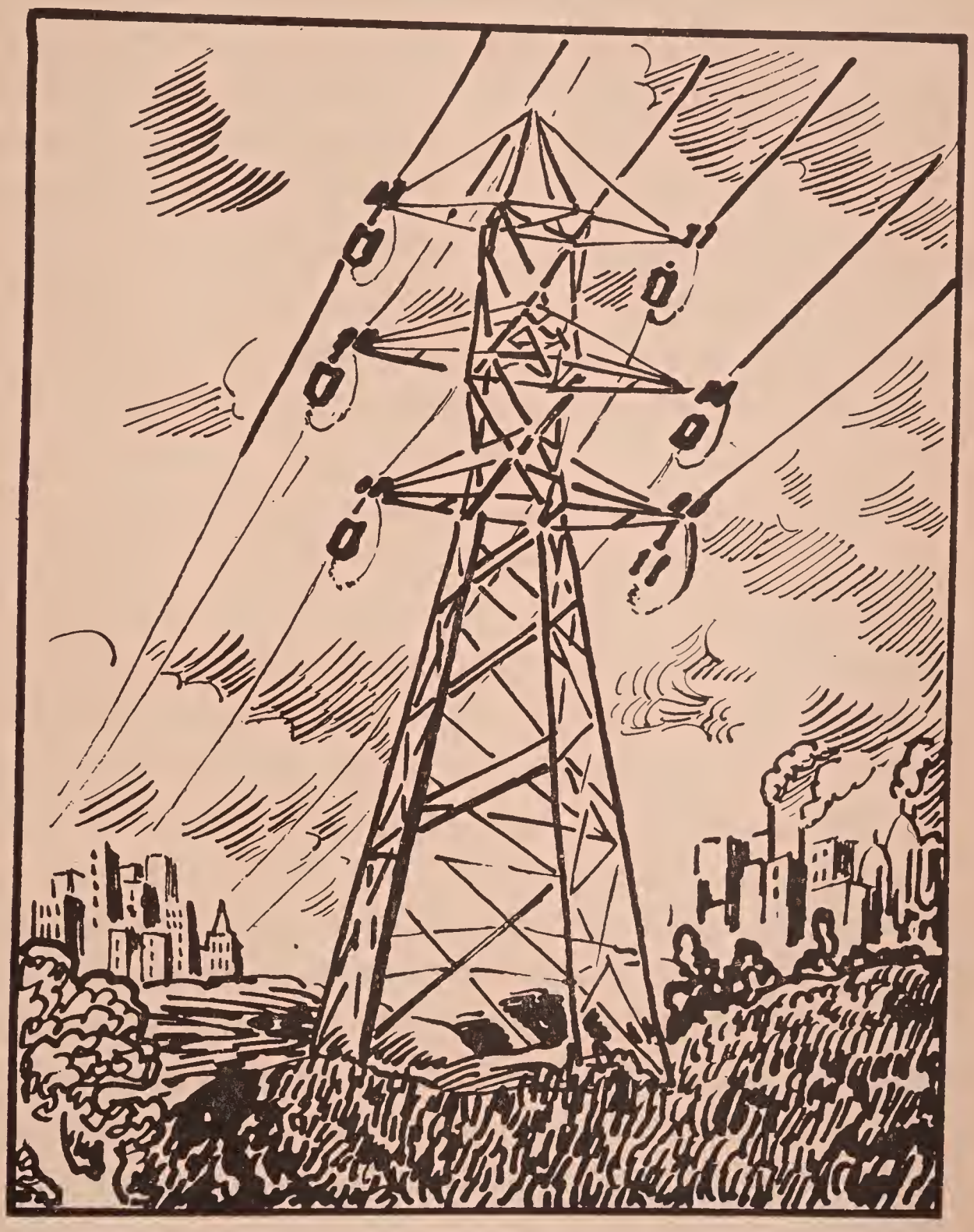
The railroads and the steamships could carry great cargoes. For this reason more and more men went into the distant wilderness to clear large farms for planting and for raising live stock. They were sure that they could ship their farm goods to the growing cities.

To feed the great number of people in the cities, the farmers on the large farms needed new tools. Soon men invented machine plows, harrows, drills, reapers, binders, and threshers. The farmers ran some of these machines with steam engines.

How Electricity Increased Man's Power

While some men were making tools which could be worked by steam power, other men were learning to put a new force to work for them.

For a long time a few men had been experimenting with a strange force called *electricity*. Then one day Benjamin Franklin, one of the Americans who had helped the United



Electric Power Can Be Led through Copper Wire to a City a Hundred Miles Away.

States to become a free nation, helped the men who were studying electricity. He proved by an experiment that electricity and lightning are one. His experiment made inventors eager to learn how they could use this powerful force to work for men. The inventors learned how to make electric batteries. They learned how to use copper wire to carry electric currents. They learned how to send messages through copper wires. They invented ways by which electric current can give us light and heat. They found a way of changing the force of falling water into electric power.

To make electric power from water power they built power houses near waterfalls. There is one such power house near Niagara Falls, in western New York State. In a power house the great mass of falling water turns huge wheels. As the wheels turn, they set other wheels turning inside a *dynamo*. This dynamo is filled with magnets and with copper wires, arranged in such a way that the turning of the dynamo wheels charges the wires with electric power.

Water power, of course, is used near waterfalls. But the electric power made from water power is different. Electric power can be led through copper wire to light a city a hundred miles away, or to turn the wheels of factories even farther away. At present men have found that it is not profitable to carry electric current more than three hundred miles.

The Gasoline and Fuel-Oil Engines

After the discovery of electric power, men learned how to make gasoline motors. They found that they could make a

small engine in which gasoline would spray into a chamber between two wires. Here a small electric spark would cause an explosion. The exploding gas seeks escape, just as the steam in the steam engine seeks escape. The escaping gas is used to turn the wheels of the motor.

It was the gasoline engine which made possible the automobile, the tractor, the airplane. Today, some ships, trains, and factories use an oil called *fuel oil* for their engines. This fuel oil and gasoline are both made from the oil called *petroleum*.

How the New Tools Have Changed Man's Way of Living

So we see that since 1767 the steam engine, electric power, the gasoline engine, and the fuel-oil engine were invented. During this same time men invented new factory machinery. They also invented new machinery for flour and lumber mills, new mining machinery, new printing presses. Many of these machines are run by steam or electric power.

With all the new tools and the engines which run them, man has added to his strength many times over.

The new tools worked by the new engines have changed people's ways of working, both on the farms and in the cities. They have also changed ways of living. The world in which we live today is so different from the world of Benjamin Franklin's day that, if he could visit us, we should have to explain to him most of our tools and our ways of doing things. He would see a world in which the new tools worked by the new engines make it possible for many people to

enjoy comforts and luxuries which kings in his day did not even imagine to be possible.

Something to Do

If you have read this chapter carefully, you will be able to write on the blank line in the sentences below, the word or words which make these statements correct. If you cannot fill these blanks correctly, read the chapter again.

1. In ancient times the chief occupations of men were _____ and _____.
2. Their tools were made of _____, _____, or _____.
3. As man improved his ways of doing things, he made his tools of _____, _____, _____, and _____.
4. Before the time of the steam engine, man used the power of _____, of _____, of _____, and of _____ _____.
5. The first steam engine was invented by _____ _____ in the year _____. _____ _____ lived in _____.
6. An American later discovered a new power called _____. His name was _____ _____.
7. Electric power is often made from _____ power.
8. Changes in our ways of living have come about because man is an _____.

Chapter 29

COPPER, IRON, STEEL, COAL, AND OIL MAKE TOOLS POSSIBLE

The time, long, long ago, when people used stone for tools is called the *Stone Age*. This was followed by the *Copper Age*, when people used copper tools. The *Bronze Age* began when workers learned to make bronze by melting copper and tin together. When men learned to make tools of iron, the *Iron Age* began. The Iron Age lasted thousands of years. Then, about seventy-five years ago, when men found a way of making steel in great quantities and at little cost, there came our own age, the *Age of Steel*.

Although steel is used for making many of our tools, machines, and engines, we must not forget that without copper, coal, and oil, all our giant machinery and swift-running engines would be useless.

How then do we get these materials? Copper, coal, and oil, and the iron from which steel is made, are all obtained from the earth. Copper, coal, and iron are obtained from mines in the earth. Oil is obtained from wells in the earth.

The Copper Age and Modern Copper Mining

First let us consider copper. No one knows when or where copper was first used. It was probably discovered quite by accident.

Perhaps some Stone Age man found that a lump of this reddish metal made a better weapon than a stone. He next discovered that, when he pounded a lump of it, it did not break, but only flattened out. Then he began to hammer one side of it into a sharp edge and had a copper tool which was very strong and lasting. He could now get his food more easily. He began to mine the metal from open pits.

It was probably by accident, too, that men learned to use fire to smelt the pure copper from its ore. Perhaps some traveler found strange, glittering lumps in the ashes of his campfire. Instead of breaking when struck, these lumps were soft and dented. They had a reddish gleam. They could be hammered easily when cold.

After discovering that this metal would melt, men could see that the melted mass took the shape of the hollow in which it was found. This suggested an easier way to shape tools than by hammering.

Later men learned to mix tin with copper to make *bronze*, which was still stronger than copper. Much later they mixed copper and zinc to make *brass*. Brass has been known less than half as long as bronze.

From the copper articles which have been dug up and from a few records in writing and in pictures we know that such ancient peoples as the Chinese, the Egyptians, and the Hindus used copper as early as several thousand years before the time of Christ. The Bible tells us of Tubal Cain, who taught people to work in copper.

The Egyptians probably used copper for beads and pins

long before they made tools of it. There is still preserved a copper button found in an Egyptian tomb which dates back to 4400 B.C.

One of the earliest tools of the Egyptians was a long copper saw with which the great blocks of stone for some of the pyramids were cut.

There were coppersmiths, or copper workers, in ancient Egypt who carried on a regular business and supplied orders. There are still to be seen crude pictures of their furnaces and bellows.

Copper pipes have been found in an Egyptian temple — a plumbing system thousands of years old! Copper pipes carried water to the king's palace. Not long ago a piece of copper pipe in good condition was dug up near the tomb of a king. It is estimated to be at least 5400 years old.

If you could have visited an ancient Egyptian market, you would have seen people using heavy copper rings instead of money. One important use of copper today is for coins. Every coin we use, even a gold piece, contains some copper to make it wear longer. The Egyptians grew very wealthy from their trade in metals. Most of their copper came from the peninsula of Sinai, which is at the northern end of the Red Sea.

There are records preserved which tell us that the Chinese early used copper. They mined coal to get fuel to smelt the copper. They soon became skilled in working bronze, for their tin and copper mines and their coal mines were near one another. Their bronze vessels inlaid with gold and silver are beautiful.

When our country was discovered, the white men found the Indians using copper necklaces, bracelets of copper beads, copper spears and arrowheads, and copper knives. They found the mines from which the Indians had been taking copper. They found some of the Indian mining tools. In the open mines they found huge lumps of copper which the Indians had not been able to take out.

One huge lump, weighing as much as four tons, the Indians had managed to move about two miles from the mine. There it stayed for years until, in 1843, it was moved to Washington and placed in the National Museum.

The copper region south of Lake Superior furnished most of the copper the Indians used. This region still furnishes large quantities of copper.

Wherever men find signs of large deposits of copper, they sink shafts and tunnels into the earth. When a miner goes to work, he enters a cage which lowers him through the shaft to his working level. Down the timbered shaft he goes, several thousand feet a minute, perhaps nearly a mile below the surface of the earth.

Once in the mine some men work to blast the rock. Others load the broken-up ore on ore cars. At the different levels small railways haul the cars to the shafts. The copper ore is then hoisted to the top and sent to be smelted. Much of the copper comes out as ore, mixed with rock, soil, and other impurities.

Some of these mines are like great underground office buildings, with their many workers, many floors, their cages

to carry men and freight, their telephone systems, their ventilating systems, their fire protection.

If the ore lies very near the surface or if there is a hill of copper, as sometimes happens, 'open mining' is used; that is, the ore is removed in the open by steam shovels and railroads. Around such mines have grown up small cities where smelting and sometimes manufacturing of copper is done.

After the ore is melted down in furnaces, the pure molten copper is cast into ingots, or bars, which are cooled. Many of these ingots are sent to factories where workers mix the copper with tin and zinc to make bronze and brass fixtures. Much copper is sent to the wire mills, where machines draw it out into the fine wire which is used to carry electric current.

Today, the world over, there are millions of miles of copper wire which help to transmit messages, light cities, and turn the wheels of electric engines.

Next to iron and steel, copper is the most useful metal today. However, aluminum can be drawn out into wire to transmit electricity and is being developed for use in some places.

It is said that one piece of telephone cable only two and one-half inches across may contain twelve hundred pairs of copper wires.

In our homes copper is serving us every hour in the day. Because of it, we can have electric stoves and toasters, washing machines, vacuum cleaners, electric fans, and other appliances which make work easier and our lives more

comfortable. Many homes are roofed with copper and screened with copper. The best hardware for the home, as door knobs and locks, is made largely of copper. So is the best plumbing.

We can see that copper is a valuable servant of man in doing the work of the world. Imagine what would happen if the supply of copper should suddenly be used up. What would happen to transportation? How could people communicate with each other easily? What changes would have to be made in your homes?

The Story of Iron and Steel

In Chapter 22 you read something of the early history of iron.

Iron, like copper, is obtained from mines in the earth. Like copper, the iron ore is an ore which must be purified by fire. When the ore comes from the mine, ships and trains carry it to the iron mills or the steel mills.

Inside the iron mills, great metal cups, or crucibles, holding tons of iron ore, glide on pulleys along overhead cables to the furnaces. Here blasts of hot air and gas are forced through the crucibles to melt the iron in the ore. The white-hot liquid iron is then poured into large molds and allowed to cool. The cooled ingots, called *pig iron*, can be used for making iron tools of any shape or size, or they can be sent to the steel mills to be made into steel.

In the steel mills, the iron ingots are once again melted down, and limestone and other minerals are added to the

molten iron. Then crucibles of this white-hot liquid mixture are carried along cables to the blast furnace where a draft of hot air is again forced through the metal. Great flames, orange, blue, yellow, and purple shoot out of the crucible. The men watch the flames because the colors tell them when the impurities have been burned away. So liquid iron becomes liquid steel.

We have read something of this in Chapter 22 in the story of building materials. There we are told only how the liquid steel rolled into steel beams and girders is used in building tall houses. But this is only one of the uses of steel.

Steel is used in the building of bridges, which, swinging across rivers and over deep mountain chasms, help to carry trains on their way. Heavy steam locomotives are made of steel. Steel machinery made the clothes and tools which the train is carrying from the cities to the farms. Steel harvesters gathered the wheat which the trains are carrying to feed the cities. The ships which bring us sugar, fruits, spices, from the far ends of the earth are run by steel engines.

Steel! Steel! Steel! How many tasks steel tools and engines with their tireless bodies and their tireless arms perform for us!

Many engines are run by electric power, which is made from water power; other machines and engines must have either coal or oil for fuel. The heat which is in these fuels helps to drive our steam engines, our oil engines, our gas engines.

The Story of Coal

Coal is obtained from the earth by mining. The coal in the earth is really the remains of forests and ferns, buried ages ago. Through countless years the buried plants, packed tight by the weight above them, change to the hard black stone which we call coal.

This same process is going on today in some of our swamps and peat bogs. Of course, the coal now being formed is made of the remains of different plants from those that made the coal we are burning. There are no fernlike trees in our country today, as there were when our coal was made. Perhaps the coal beds now being formed will show prints of our hardwood and evergreen trees.

In coal the heat which the plants of long ago gathered from the sun is stored in less space than in wood. A small pail full of coal will give more heat than a great log of wood. For this reason, since about one hundred years ago, people have been using coal rather than wood as a fuel for furnaces and engines.

Coal, like the other minerals we have studied, has had a long and interesting history. Very early, man discovered that this black 'rock' would burn. Flint axes have been found buried in coal mines in England. The Romans found the Britons burning 'black stones.' You have learned earlier in this chapter that the Chinese used coal to smelt their copper. They also used it to bake their porcelain.

There are records of grants of land for coal-digging in

England as early as the thirteenth century. Coal was being sent to London by ship, and even then there were complaints about the smoke! For a time, the use of coal was forbidden in England. It was not until England had used up most of her forests, by burning charcoal, that coal began to be burned in large quantities.

As early as 1679, soft coal was reported by Father Hennepin when he was exploring in what is now Illinois. Later, *anthracite*, or hard coal, was discovered. People thought it was too hard to burn, and some of it was cracked up and used for roads. It was a long time before people began to realize its value. When the railroads and steamboats came, the coal industry began to grow.

In our country there are great deposits of hard coal in mines in the eastern part of the state of Pennsylvania. There are deposits of soft coal in many parts of the country.

Where coal is found in mountains, tunnels are dug sideways into the mountain walls. More often, the miners must sink shafts down into the earth. Then at different levels, they dig horizontal tunnels which are like underground roads branching off from the shafts. Heavy beams keep the tunnels from caving in.

In some mines there are miles of these underground tunnels. To reach them, men enter a cage at the top of the shaft. A cable lowers the cage to the level on which the men work. They get out into the dark tunnel.

To light their way, they have lamps attached to their caps. This leaves their arms free to work. The lamps are safety

lamps. No match or open flame must be carried here because in the mines there is a gas called *fire damp* which may explode.

The men find their way to the mass of coal which they must mine. They then drill holes into the rock. They place a cartridge in each of these holes. By means of fuses, they explode the cartridges, thus breaking loose coal and rock.

Helpers load the loosened coal on to carts. Pushed by hand, drawn by mules or by engines, the carts carry their loads to shafts through which the coal is sent up out of the mine.

Some coal is removed by steam shovel and open mining, just as copper is. Open mining is not so hard nor so dangerous as underground mining and requires fewer men.

When the coal is sorted according to size and separated from rock and stone, it is ready to be sent to factories, mills, and homes.

More coal is transported by rail than in any other way. Most of the coal for New England, except near the ocean, comes by rail. On the Great Lakes, coal is sent in whaleback steamers. On the Ohio, it is shipped by barge or flatboat.

Since the greatest amount of coal is shipped north to our great manufacturing cities, it is important that it be shipped before winter sets in. For during the winter months many rivers are frozen, so that boats cannot travel on them, and snow hinders the movement of freight on railroads.

There are different kinds of coal, depending on the kind of

plants composing it, the length of time it has been forming, and the amount of pressure it has had.

Brown coal, or lignite, is the nearest to peat. It is like wood and breaks up easily. It will not furnish the heat that other coals do.

Soft, or bituminous, coal, so valuable in manufacturing, has been longer in forming and has had greater pressure. It furnishes great heat and burns with a great deal of smoke. It takes more than a ton of soft coal to smelt a ton of iron ore and more than four tons to produce one ton of steel.

The hardest coal is the anthracite of the eastern states. It is the best coal for heat in the home, because it is clean and burns well with little or no smoke.

Any kind of coal can be used for locomotive fuel. Steamships need coal which gives great heat but is light and is not bulky. Practically any kind of coal, even low-grade brown coal, can be used for steam and power.

In large cities, coal is used to make gas, which is stored in tanks and then carried by underground pipes to furnish gas light or to burn in gas stoves. People burn coal in furnaces to heat their homes. Coal is used for making dyes to color our cotton, linen, silk, and wool. It is used to make benzine, which dry-cleans our clothes. Coal is used to make ammonia, which is used to make artificial ice.

All these uses of coal are important, but most important of all is its use as the fuel which changes water to steam and so drives the steam engines which are working for us day and night.

The Story of Oil

Coal gives our engines power. Oil furnishes not only power, but also the needed material to prevent friction in all sorts of engines and machinery.

The gasoline which drives our swift automobiles and airplanes, the fuel oil which runs many engines, the lubricating oil which makes the wheels of engines turn more easily, all come from petroleum.

Petroleum means 'rock oil.' This oil, formed from plants and animals which lived on the earth ages ago, is found stored up in porous rock, like water in a sponge.

Petroleum has been known to man for thousands of years. Long ago people in different lands saw pools of a sticky substance which burned when it was thrown upon a fire. This was oil which had oozed up from its rocky underground home.

Ancient writers mention the use of oil for medicine. This seems to have been its first use. Marco Polo records that a hundred ships could be filled at a time with oil from the lake at Baku, that it was not good to eat, but that it was good to burn and to cure the sore backs of camels.

The Chinese drilled oil wells before the time of Christ. The Greeks used oil to frighten their enemies, for it could burn on water. The Egyptians used it for pitch and mortar and also in preparing mummies. They regarded the places where oil was found as holy. There is an account of the oil springs of Sicily where petroleum was used in lamps.

One of the first Greek historians, Herodotus, has left an account of how he had seen oil obtained. It was swabbed up from the lake with a branch of myrtle. A pole was let down into the water, with a bunch of myrtle tied to one end.

In our country there were places where the Indians saw oil floating on the surface of creeks or rivers. This, too, had oozed from the earth up into the streams. When the white people came to this country, they used some of this oil as a medicine. They believed it would cure many illnesses; they even believed it would cure baldness.

The settlers collected petroleum from the surface of the water with woolen cloths in much the same way that Herodotus tells about.

Sometimes oil was regarded as a nuisance. When drilling for salt, the settlers often got oil with it. This spoiled their salt.

One of the places where people found oil floating on water was Oil Creek in Pennsylvania; and it was near this place that a man named Colonel Drake, digging into the earth, struck the world's first oil well about sixty feet down. As this oil sold for forty dollars a barrel, hundreds of other men began drilling wells for miles and miles around Drake's well. Many of these men struck oil, and from that day to this some of the wells in Pennsylvania are still pumping up oil. Since that time oil has been found in many other parts of the United States.

Once people learned ways by which they could get petroleum easily, they looked for new ways in which petroleum

could be used. Before long they found marvelous uses for it.

Petroleum is not used as it comes from the earth. It is first purified in refineries. In the refineries, petroleum is heated in huge metal-lined kettles which are called *stills*. As the oil becomes hot, it gives off gases. At one temperature it gives off one gas. At higher temperatures it gives off other gases. Pipes leading from the still carry these gases to cool tanks, called *condensers*. Here the cold changes the gases to liquids. In one condenser the gas obtained at another temperature changes to gasoline. In the refineries, lubricating oil and a heavy fuel oil are also made from petroleum.

Kerosene oil, which is also made from petroleum, proved a boon to farmers who could not get either gas or electric light for their homes.

As a fuel, gasoline made possible the automobile and the airplane. Without this liquid fuel, which burns drop by drop, the automobile and the airplane would have been impossible. Before the value of this product of petroleum was known, gasoline was regarded as a waste product; only kerosene was considered valuable.

The lubricating oil is used to grease engines so as to reduce friction between the parts. Without lubricating oil, our machines and engines could not run nearly so fast. In fact, the friction would soon wear out the parts; the heat from the friction would ruin the engine.

Now people are using fuel oil, very much as coal is used, to run engines on railroads, on steamships, and in factories.

Fuel oil can be sent for long distances more easily than coal. It is easier to load a ship with fuel oil. It is easier to feed a boiler oil than to feed it coal.

With these uses for kerosene, gasoline, lubricating oil, and fuel oil, people have been wanting more petroleum and more petroleum and still more petroleum.

For tens of years men have been searching all over the United States and all through the rest of the world for signs of oil fields. These men have found great oil fields in many parts of this country outside of Pennsylvania. California, Oklahoma, Texas, all help to give us much of our oil. Mexico has great oil fields. So has Russia. Still the search for new oil fields goes on.

Where the signs seem to be right, men drill into the earth. They begin by building a huge derrick. From this derrick they hang their drill, which may weigh a ton. A steam engine works the drill, which pounds its weight away down through rock and soil a hundred feet, a thousand feet, sometimes two thousand feet, and even more.

Drilling an oil well is very costly. The people who have risked their money to pay for the drilling wait for word. Will the drillers 'strike oil' or not? Often they do not. The earth below is dry, and all the money spent in drilling is then lost. On the other hand, drillers sometimes strike such a good well that the oil comes gushing up through the pipe and spouts away up into the air, a stream of black, flowing oil which brings gold to the men who own it.

But today oil is carried through *pipe lines* to huge tanks

where it is stored. These pipe lines are laid under the earth.

From the storage tanks other pipe lines carry the oil for hundreds or even thousands of miles to the oil refineries. These great trunk lines can transport large amounts of oil more cheaply than it can be carried by rail. Sending a barrel of oil by pipe line costs from four to ten cents per hundred miles.

Oil is also carried by tank cars, by tank ships, and by motor trucks. Tank ships move great volumes of oil from the California oil fields to the eastern refineries.

California is noted for the size and number of its oil wells. Many of the wells are over a mile deep.

In this country alone, billions of gallons of petroleum are used each year, and billions of gallons will be used in each year to come. No wonder the great nations of the world are all eager to make sure that their people will not lack oil for a long time in the future.

Our modern world, you see, would be impossible without the minerals we have been studying about in this chapter.

Things to Do

1. Make a list of all the useful metals mentioned in this chapter.
2. After you have made a list of the metals, make a list of the things which are made from each of them.
3. Make a list of the minerals mentioned in this chapter.
4. Now list the uses we make of these minerals.
5. Coal has a very interesting story. Tell it to your class

or write it in your notebook. Some of the things you will want to tell in your story are how it is formed, where it is found, how many kinds there are, how it is mined, and what it is used for.

6. Write a story describing the work of a coal-miner.

7. On an outline map of the United States, mark out, in some way, the coal regions.

8. Be sure you know the meaning of the word *by-product;* then find in the chapter all the by-products of coal.

9. Tell what these by-products of coal are used for.

Chapter 30

BOOKS AS TOOLS

When you think of tools, you probably think of hammers, saws, hatchets, knives, and many other things which you use with your hands to help you do some kind of work.

You hardly think of books as tools. But books are tools, because they help you in finding out so many things that you need to know. And the more you know, the better you are able to think. If you had no books, you never could know anything about the important things that have happened in the past. You could not know so much as you do about other places and peoples. You would have no interesting stories to read when you want to sit quietly in your homes. You could not enjoy reading about people and events in far-away places.

Tablets, Papyrus, Parchment, and Paper

The story of books is an interesting one. Long before printing was invented or paper was made, men kept records of events on clay tablets. The clay tablets of Babylonia and Assyria were collected into libraries and might be called ancient books.

As long ago as 2500 years before Christ, which was later than these ancient tablets, the Egyptians preserved their

sacred records on a papyrus roll. This roll had eighteen columns of picture writing and is still preserved in the museum called the *Louvre*, in Paris, France.

As long as papyrus was in use, books were made in the form of *scrolls*, or rolls wound around a stick. The writing was arranged in narrow columns across the scroll, very much like the columns of a newspaper today, except that in these ancient times picture writing was used.

Papyrus was made of the bark of a plant, pressed into a flat piece of fiber. This was hard to secure and some other kind of material had to be found. An ancient king, living about two hundred years before Christ, began to study ways of improving the skins of sheep and calves for writing purposes. These skins were called *parchments* and were in use for eight hundred years.

In the tenth century before Christ men began to make a writing material from a pulp of linen rags. This began in China. Many centuries after the Chinese discovered a way of making paper, paper mills were set up in Europe and the use of paper began to spread.

The invention of printing, which you will read about in a moment, led to an increase in the making of linen paper. When printing became common, paper was made from wood pulp. Pulp paper is much cheaper than linen paper, but does not last nearly so long.

The Early, Hand-Made Books Were Beautiful but Costly

Books were originally sacred writings or records of sacred events and so belonged to the churches. For a long time men continued to write and copy books on scrolls, but there came a time when men made books in the same form as this book.

Books became very elaborate and beautiful. Some of them were bound in gold and set with precious stones, and often they had beautiful illustrations of fine engravings which made them lovely picture books.

During the Middle Ages the learned men copied the writings of men who had lived centuries before them. These books were written by hand and they were very expensive. It took a long time to make them. No one except the very rich and learned people could afford to buy them. The poorer people never even saw them.

Since there were few books, no one except the learned class knew how to read.

The Printed Book

Then came the printed book, which opened the art of reading and book learning to the people. The craft, called *letter-printing*, which was done on wooden blocks, was also discovered by the Chinese. They were the first printers as well as the first paper-makers. The oldest known printed book was found in China. It has this statement written

upon it, "Printed on May 11, 868, by Wong Chilk for free distribution, in order in deep reverence to perpetuate the memory of his parents." You see in those ancient days books were dedicated to some honored person, just as we sometimes dedicate them today.

Printing from movable type was first done by Pi Shing in China in the years 1041 to 1049.

No one knows when or where in Europe printing from movable type began. It is supposed it happened about 1440, but there are many different stories told about this invention. Germany, Holland, France, and Italy each claims it.

But it is believed that Holland has the honor. In Haarlem, in Holland, a man named Coster was printing from movable type before 1446, and Johann Gutenberg was printing at Mainz in Germany about the same time. There were printers in Italy in 1465, and Caxton set up his press in England in 1477.

The pages of the earliest books were printed to look like the hand-copied manuscripts, for the printers did not want their invention discovered. The Bible was among the first books to be printed. There were three hundred copies made during those early times; only forty of them are known to be in existence now. The others must have been lost or destroyed centuries ago.

What Printing Means to Us

Through the centuries many improvements in methods of printing by machinery have been made.

Newspapers can be printed so quickly that people all over the world can have daily newspapers to read. And many publishers of newspapers print both a morning and an evening paper. Frequently when some important event takes place extra editions of newspapers are printed. You have heard the newsboys selling these extras in the streets of your own town or city.

So it is with magazines and books. Nowadays there are so many magazines printed every month, and so many books are published, that no one could possibly read them all. It is a contrast, indeed, to conditions a few centuries ago when few people knew how to read because there was almost nothing to read. Now with so much to read, there are very few people in civilized countries who cannot read. And those who love to read have a hard time to decide what of the mass of reading material they will read.

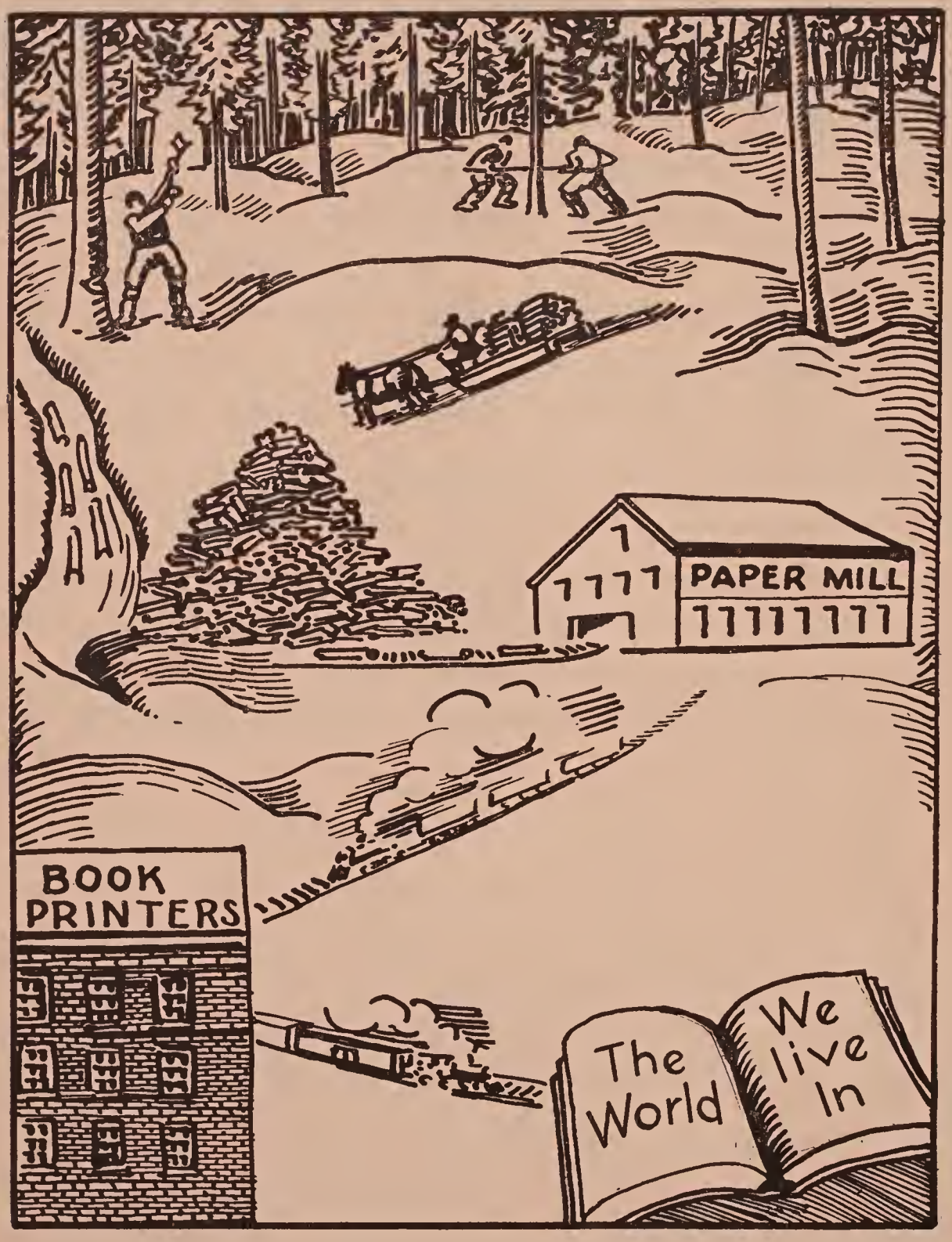
You see what the invention of printing has done for us. Until books were printed, not only did very few people know how to read, but there were not even any schools for the children of the working classes. There were no schoolbooks, no magazines, and no newspapers. There was no way for man to preserve the knowledge of the past so that all could learn from it, as we can today. There was no way for news to spread so that all might know about things that were happening in other places.

Books help us in many ways. We read them when we want to be entertained in our leisure hours. We go to them when we want to learn something that we could not find out in any other way.

Things to Do

If you have read the chapter carefully, you can tell what words should be added in the blank spaces to make these statements correct.

1. The earliest books were made in the form of _____.
2. Printing on wooden blocks was invented by the _____.
3. The oldest known printed book was found in _____.
4. Printing from letters cut on a wooden block was first invented by a _____.
5. The first printing press was invented by _____ _____ in the year _____.
6. Until books were printed, few people _____ _____ _____ _____.
7. Make a list of all the ways books are a help to you.
8. Make a list of the books you have enjoyed reading.
9. If you live near an art museum and there is a collection of old books there, your class might arrange to go to see them.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